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The World Bank

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Report No. 2770a-KO

KOREA

STAFF APPRAISAL OF

SEVENTH RAILWAY PROJECT

April 1, 1980

Projects Department
East Asia and Pacific Regional Office

CURRENCY EQUIVALENTS

Currency Unit - Won

Until January 15, 1980

US$1	=	W 485
W 1,000	=	US$2.06
US$1 million	=	W 485 million
W 1 million	=	US$2,061

From January 15, 1980

US$1	=	W 580
W 1,000	=	US$1.72
US$1 million	=	W 580 million
W 1 million	=	US$1,724

WEIGHTS AND MEASURES

1 m	=	3.28 ft
1 km	=	0.62 mi
1 kg	=	2.2 lb
1 l	=	1.057 qt (US liquid)
1 ton	=	2,205 lb

ABBREVIATIONS

ADB	-	Asian Development Bank
CTC	-	Centralized Traffic Control
EPB	-	Economic Planning Board
FFYP	-	Fourth Five-Year Plan
KAL	-	Korean Airlines
KDB	-	Korean Development Bank
KFW	-	Kreditanstalt fur Wiederaufbau (Germany)
KFX	-	Korean Exchange Bank
KIST	-	Korea Institute of Science and Technology
KMPA	-	Korea Maritime and Port Authority
KNR	-	Korean National Railroad
MOC	-	Ministry of Construction
MOHA	-	Ministry of Home Affairs
MOT	-	Ministry of Transportation
OECF	-	Overseas Economic Cooperation Fund (Japan)
OSROK	-	Office of Supply, Republic of Korea
SMESRS	-	Seoul Metropolitan Electric Suburban Railway System
TCC	-	Transport Coordination Committee
TCO	-	Transport Coordination Office

GOVERNMENT OF KOREA
FISCAL YEAR

Jamuary 1 - December 31

KOREA

STAFF APPRAISAL OF THE SEVENTH RAILWAY PROJECT

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This report is based on the findings of a Bank mission which visited Korea in September/October 1979, comprising Messrs. Levy (financial analyst), Ohlund (engineer), and Yenny (economist).

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KOREA

STAFF APPRAISAL REPORT OF A

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1. TRANSPORT SECTOR

General

1.01 The fundamental changes in Korea's economy over the past decade have been accompanied by major development and changes in the transport sector. Freight and passenger traffic tripled between 1966 and 1976; and results for 1977 and 1978, the first two years of the Fourth Five Year Plan 1977-81 (FFYP), show a continuation of the trend. As industrialization spread throughout the country and GNP per capita more than doubled, Korea developed its road transport system and its coastal shipping, and the railway lost its preponderant position.

1.02 Traffic statistics (Tables 1.1 /1 and 1.2) illustrate these changes over the 1966-76 decade. The rail transport share of freight traffic fell from 78% of total ton-km to 45%, while road and coastal shipping shares increased respectively from 12% to 30% and from 10% to 25%. For passenger traffic, the rail share of total passenger-km fell from 43% to 25% over the decade, while the road share increased correspondingly from 56% to 74%. These trends have continued since 1977, although at a much slower pace as modal allocation is gradually reaching equilibrium. These relative changes in modal split reflect the economic advantages of the various modes, as rail and coastal shipping increasingly concentrate on long distances and bulk commodities, while road transport handles short distance and more diffuse traffic.

1.03 The basic sector strategy has been and continues to be increasing the capacity of the system fast enough to avoid bottlenecks that would cripple the rapid growth of the economy. Thus the Government has been allocating regularly, since the beginning of the Second Plan in 1967, about one quarter of its total capital expenditure to expand and modernize transport infrastructure. Investments have been concentrated on the Seoul-Busan axis where most industrial development is taking place and on corridors to the northeastern part of Korea to serve the country's coal mines and cement plants. The FFYP public and private investment allocation for the transport sector is Won 2,784 billion (US$5.7 billion). It is expected that 45% (Won 1,258 billion) will be invested by the public sector in infrastructure and equipment. The remaining 55% (Won 1,526 billion) will be invested by the private sector, primarily for road vehicles and ships (Table 1.3). Actual investments for 1977 and budgeted ones for 1978 and 1979, deflated to 1975 constant prices, indicate that implementation is about 10% behind the plan target (Table 1.4). However, actual investments in 1977 were only 80% of that

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/1 Tables are given in Annex 3.

year's budget which would indicate greater lag behind the plan then shown by the budgeted amounts for 1978 and 1979. A further shortfall is expected in 1980 as a result of a very tight budget, and some delays are anticipated in the implementation of highways and ports projects.

1.04 Other major sectoral objectives have been to constantly improve the efficiency with which the transport system is used, and to establish institutions to plan, construt, maintain, and operate the system efficiently. The Bank has played a very active role in advising and assisting the Korean authorities in pursuing these objectives and establishing such institutions as the Bureau of Public Roads (BPR) in the Ministry of Construction and the Korea Maritime and Port authority (KMPA); and in strengthening the Korean National Railroad (KNR).

1.05 For many years, the transport system has been strained by the demands of rapid economic growth. As a result, and to ensure that development priorities were reflected in the allocation of scarce transportation means among competing claims, the Government established fairly tight regulations in the sector. Licensing regulations in the road subsector are still restrictive despite some relaxation in recent years and tariffs for all modes are set by Government. Now that the system is more developed and also more complex, these rgulations should be relaxed to allow the market to determine the most appropriate levels of service and tariffs. The Bank has maintained a dialogue with Korea on sector legislation, mainly through highway projects, and on tariff adjustments, mainly through railway and port projects; it has also contributed to a better analysis of investments in the entire sector and to transport coordination in general. Partial relaxation of commercial road vehicle licensing was implemented in 1977, and road, rail and port tariffs were increased several times during recent years. The new trend in the Economic Planning Board (EPB) is for further liberalization of the economy in general, but there is still a strong preference among many agencies for retaining as much control as possible. Through its lending operations in the sector, the Bank will continue to press for greater flexibility in the use of the transport system and in tariff setting, as well as assist Government in investment planning analysis and transport coordination. In particular, assistance will be provided in 1980 and 1981 during the preparation of the country's next five-year plan 1982-86.

The Transport System

Road Transport

1.06 The present highway system is still inadequate to cope with the rapid growth of road transport, despite the Government's effort since 1968 to develop a modern road network. Only 58% of the national road, 8% of the provincial roads, and 3% of the county roads are paved, and a high level of investment will continue to be required. The Bank Group has financed four highway projects, totalling US$334.5 million: Loan 769-KO in 1971 (US$54.5 million), Loan 956-KO in 1975 (US$47 million), Loan 1203-KO in 1976 US$90 million) jointly with a loan by the Saudi Fund for Development, and

Loan 1640-KO in 1978 (US$143 million). Performance on these projects generally has been satisfactory. The major institutional achievements of these projects have been the creation and development of the Bureau of Public Roads in the Ministry of Construction (MOC) and the setting up of MOC field organization for maintaining the national road system. A study is now underway to review the institutions dealing with provincial and gun roads, which come under the jurisdiction of the Ministry of Home Affairs (MOHA), and it is expected that future road projects will assist with institution building within MOHA for the development and maintenance of these roads.

1.07 Road transport of freight and passengers grew rapidly over the last decade and, as mentioned above, the share of road transport increased dramatically at the expense of the railways. However, the motor vehicle fleet in Korea is still small when compared with other countries of similar and even lower income levels. The 385,000 four wheel road vehicles registered at the end of 1978 amount to only 10.4 per 1,000 persons; while the ratios are 14.3 in Thailand, 15.4 in the Philippines, and 48.2 in Malaysia, all with lower per capita income than Korea. There are many reasons why Korea's vehicle fleet is small: the high taxation of private cars, the restrictive licensing of commercial vehicles, the high cost of locally manufactured vehicles, and the recent development of the road network. Only 15 years ago, Korea had less than 1,000 km of roads.

1.08 Starting from a small base, the vehicle fleet is growing rapidly; the number of private automobiles almost doubled over the last two years. One of the most important issues now faced by Government in the transport sector is the appropriate roles of private (automobile) and public transport. While the private car and taxi offer a versatile and economic way to meet transport demand in rural areas and small towns, their uncontrolled use in the larger cities would create congestion and require massive investments and space. This point is illustrated by recent road investments by the cities of Seoul and Busan, which totalled US$374 million in 1977 and 1978, and thus exceeded central government road investments for the rest of the country over this period. The Government is, however, pursuing its policy to restrict ownership and use of private cars. The cost of the smallest car is about US$5,600 of which 40% is tax; annual license for the same is around US$200; and the price of regular gasoline was increased to US$4 per gallon in January 1980.

Railways

1.09 As mentioned above, the railway has lost its predominant position in relative terms, but both freight and passenger traffic have continued to increase in absolute terms. Cost comparisons indicate that rail transport is still the most economic means of moving bulk traffic over medium and long distances, and also has an important role to play in long distance passenger traffic. In 1978, about 76% of rail freight traffic consisted of six bulk commodities. In addition to its long distance hauling of bulk freight and passengers, KNR plays a growing role in providing rapid transit service for Seoul and its suburbs. Details are given in Chapter 2.

1.10 Since 1962, the Bank Group assisted KNR through six projects totalling US$340 million. The first four lending operations have been satisfactorily completed. Disbursements of the Fifth Railway Loan 1101-KO) are 96% completed. The Sixth Railway Loan (1542-KO of US$120 million in 1978) is proceeding on schedule and the loan is expected to be almost fully disbursed by end 1980; at which time the disbursement of the proposed project will start. Much progress has been made through this continuous assistance in providing KNR with more autonomy, both operationally and financially. A management study carried out under the Fifth Project has recently been completed and its recommendations form the basis of a time phased plan to complete the transformation of KNR into a public corporation (para. 2.02 to 2.04).

1.11 KNR earned positive returns until 1971. Since then, the financial performance deteriorated under rapid inflation and the reluctance of Government to increase public sector tariffs so as not to further contribute to inflation. Tariff increases agreed under the Sixth Project were granted in 1978 and 1979 and the financial situation has improved. The proposed project will concentrate more on the structure of tariffs than on overall tariffs increases (para. 2.34). The requirements of covenants covering operational and technical matters have, in general, been met satisfactorily, with a consequent improvement in KNR's level of performance. Progress has also been made in building up on organization in the Ministry of Transportation to coordinate transport planning and investment (para. 1.15 to 1.17).

Ports and Shipping

1.12 Freight traffic through the ports has increased from about 13 million tons in 1966 to over 110 million tons in 1978. This tremendous increase resulted in serious port capacity problems, particularly at Busan, the largest port, which handles 20% of the country's external trade and is chronically congested. The Bank has assisted development in Busan through two port projects totaling US$147 million and the Asian Develpment Bank (ADB) is financing the expansion of Incheon, the port nearest to Seoul. The Saudi Fund for Development participated in the financing of the first Busan Port Project. The Government has also proceeded to develop a number of specialized ports serving specific industrial sites, e.g. Bugpyeong for cement, Pohang for steel, Ulsan for oil and petrochemicals, Onsan for nonferrous metals, Changwon for heavy engineering, and Samil (Yeosu) for fertilizer and petrochemicals.

1.13 The role of coastal shipping has greatly increased in the last decade, from 10% of the ton-km moved in Korea in 1966 to 25% in 1978. This is mainly due to the construction of industrial complexes on coastal locations, and, to a lesser extent, to shortages in rail and road capacity. Korea's share in the merchant shipping of its external trade has been increasing and reached 50% of the total tonnage handled in 1978.

Aviation

1.14 Although domestic air passenger traffic grew rapidly until 1973, it still amounts to less than 1% of total passenger-km; air-freight is also neglibible. Domestic routes are served by the privately-owned Korean Airlines (KAL), which also operates internationally. Most international traffic is handled at the Seoul-Kimpo International Airport; other international airports are at Busan and at Jeju Island, a major tourist center.

Transport Policy Planning and Coordination

1.15 The Government set up in 1970 a Transport Planning Office on the recommendations of a study by consultants under the Bank Technical Assistance Project - Transport, Credit S4-KO, and with assistance provided under that Credit, the First Highway Project Loan 769-KO, and the Third Railway Project Credit 183/Loan 669-KO. Over the past few years, the Government has taken steps to further improve transport coordination. In 1975, this function was reorganized by the establishment of a Transport Coordination Committee (TCC) consisting of nine directors, representing ministries most directly concerned with transport matters, and a Transport Coordination Office (TCO) in the Ministry of Transportation (Chart 19013)./1 In 1977, recognizing the importance of its function, the Government upgraded the position of the head of the TCO from director general to assistant minister, and in 1979 the newly appointed assistant minister reorganized the TCO, centralizing the planning and coordination of all modes of transport into one division with the bulk of TCO's staff. Smaller divisions deal with matters pertaining to KMPA and KNR, and with economic cooperation.

1.16 The planning and coordination division now prepares annual traffic forecasts for all modes of transport. Early in the year, it also compiles and reviews all investments in the sector and, after discussions with the respective agencies, submits an agreed investment budget to EPB. The TCO also prepares, with other bureaus of MOT, proposals for tariff changes which are then discussed with EPB. The EPB, which exercises budgetary control and plays a senior role with regard to all other ministries, has the final decision on investment projects as well as on tariffs in the sector. To review major investment projects, EPB has established a separate Bureau of Project Evaluation. The function of this bureau is however mainly to ensure that the investment projects are adequately prepared and, in the case of transport projects, the Bureau has so far relied on the preparation work of specialized agencies and TCO. This arrangement is adequate to avoid duplication of work.

1.17 The TCC does not meet often formally, but its members have informal discussions as problems warrant. For instance, a working group for the preparation of the next five year plan, 1982-86, has already been formed under the direction of the assistant minister TCO, and with representatives of

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/1 Charts are given in Annex 3.

the ministries and agencies dealing with transport and those using transport such as agriculture, commerce, and industry. Five year traffic forecasts for all modes will be prepared by the spring of 1981, and a sector investment plan by the end of July 1981. This effort will be greatly assisted by the comprehensive transport study now being carried out by the Korea Institute of Science and Technology (KIST) under the Sixth Railway Project. The study is expected to be completed toward the middle of 1980. Training of Government staff is needed to improve in particular TCO's capability of performing its role in transport coordination. During negotiations, agreement was reached on a schedule for training Government staff in transport planning and coordination.

2. RAILWAY SUBSECTOR

KNR Organization

2.01 KNR is a semi-autonomous agency within the Ministry of Transportation, with its own management, accounts and portion of the national budget. The legal basis for KNR's administration and operation is set out in: (a) Law for Government Organization No. 2907, revised December 31, 1976; and (b) KNR Organization-Presidential Decree No. 7310, dated November 4, 1974. The Government, largely through EPB, exercises control over staff, financial, budgetary and tariff matters. The Administrator of KNR is appointed by the Government to assume the function of General Manager. While most previous KNR general managers were appointed from outside the Railway, the present Administrator was appointed from the railway staff. The Administrator is assisted by a Deputy-administrator who comes from within KNR and is in charge of the day-to-day operations. Chart 20944 shows KNR's organization. KNR's management enjoys reasonable day-to-day managerial freedom.

Management, Staff and Training

2.02 Management is generally satisfactory, as reflected by KNR's high operating efficiency. However, some improvement in KNR's organization is desirable to rationalize managerial functions and responsibilities. There is an immediate need to reinforce KNR's capability for financial, economic and investment planning. The Government, aware of these weaknesses, had agreed to utilize remaining funds under the Bank's Fifth Railway Loan (1101-KO) to carry out a comprehensive management study under Terms of Reference agreed during negotiations of Loan 1542-KO (Sixth Railway Project). The study was completed in September 1979.

2.03 The study's main conclusion is that KNR should be gradually transformed from its present status as a semi-autonomous Government Agency to that of a Public Corporation; to give it the necessary independence and managerial and financial freedom to fully play its role as a competitive carrier. Managerial functions would be delegated, under the guidance of a

Board of Directors and the control of the Administrator (renamed President), to three line managers (renamed Executive Vice Presidents) in charge of Planning, Coordination and Control; Operations; and Administration respectively. Chart 20995 shows KNR's recommended organization. This transformation would be prepared by a set of short and mid-term measures focussing on: (a) the establishment of a management information system and of an aggressive Marketing Organization within KNR; (b) the strengthening of KNR's capability in the fields of economic analysis for investment planning, financial management and accounting procedures, with special emphasis on implementation of performance budgeting and incremental long-term variable costing; and (c) progressive reorganization of KNR's management along the lines described above to ensure KNR's smooth transition to a public corporation.

2.04 During negotiations, it was agreed that KNR would become a public corporation no later than January 1, 1987; this date corresponds to the end of the forthcoming five-year plan (1981-86). Also agreed, was a timetable of short and mid-term measures necessary to achieve this transformation, and in particular detailed short-term measures which are given in Annex 2.

2.05 KNR presently employs about 40,000 staff of whom about 33,500 are permanent employees with Government civil service status. The rest consists of semi-permanent and temporary personnel used in workshops and on track works on a seasonal basis. Total staff is expected to attain about 48,500 by the end of 1982 to meet anticipated traffic demand. Staff productivity in terms of traffic units (pass km plus net ton km) per employee is one of the highest in the world. It reached 808,000 units per employee in 1979 as against some 500,000 in European railways. This is due partly to the dense urban and intercity passenger travel and heavy bulk mineral traffic and partly to KNR's staff discipline and professional conscientiousness.

2.06 Basic salaries and allowances are generally in line with Government pay scales. Although they were increased in average by 6.5% p.a. in real terms and 13.5% p.a. for inflation between 1970 and 1979, they are substantially lower than in comparable private industrial and commercial enterprises in Korea. This causes some difficulties in recruiting and retaining qualified and experienced personnel. Present basic salaries range from about W 40,000 (US$67 equivalent) to about W 250,000 (US$429 equivalent) per month. Allowances, which increase with length of service, range from W 25,000 to W 150,000 per month. Salaries in real terms are expected to grow at a slower pace during the next five years, in line with a somewhat lower general economic growth.

2.07 Training programs were reviewed by the Bank during the Fifth and Sixth Railway Projects under which necessary equipment and material for practical training was purchased. Training programs are now adequate and generate considerable interest among the staff. The proposed loan includes some funds for overseas training of staff, particularly in the field of investment planning and computerized commercial and cost accounting in relation with the implementation of measures referred to in para. 2.04.

Railway Facilities

Tracks

2.08 The system consists of 3,111 route-km of standard gauge (1.435 m) and 47 km of narrow gauge (0.76 m) lines; 607 km are double track and the remainder single track (Table 2.1 and 2.11 and Map 13134). There are many lines in sharp curves. There are about 140 km of tunnels and 97 km of bridges. The main lines are laid with 50 kg/m rails, while secondary lines have mostly 50 kg/m and 37 kg/m rails (see Table 2.2). All rail renewals are presently carried out with 50 kg/m rails, and 60 kg/m rails will be used on heavy traffic lines from 1981 on. Of the total number of sleepers in use about 79% are timber and 21% are concrete. Rail joint welding is carried out to an increasing extent with about 244 km completed by the end of 1978. All lines have crushed stone ballast.

2.09 During the proposed project period (1980-81), KNR plans to carry out renewal of about 320 track-km of worn out rails. KNR will also continue its sleeper and ballast renewal program. A workshop for the manufacture of points and crossing components, the preparation of timber sleepers and the rehabilitation of used track material is being set up.

2.10 Existing double track lines are the Gyeong Bu and Gyeong In lines, section Daejeon-Iri of the Ho Nam line and section Bongyang-Jecheon of the Jung Ang line. Doubling of the Chung Bug line is ongoing and will be completed by the end of 1980. In the Seoul area, quadrupling of the Yeongdeungpo-Suweon section and doubling of the Yongsan-Susaeg and Seongbug-Euijeonbu sections for suburban services will be completed by 1981.

2.11 The single track industrial lines between the northeast and Seoul are electrified. The electrification of the Jung Ang line between Jecheon and Yeongju, earlier considered for 1980/81 has now been deferred to the next plan period. Most of the Seoul urban tracks are also electrified, in association with the Seoul Metropolitan Electrified Suburban Railway System (SMESRS); extension of the electrification to the Yongsan-Susaeg and Seongbug-Euijeonbu lines will be completed by 1981.

Signalling

2.12 Centralized traffic control (CTC) has been installed in the Seoul urban area and on the heavily trafficked electrified single line Seoul-Jecheon. Under the new project, CTC is to be installed on the section Yeongju-Gyeongju of the Jung Ang line (about 164 km deferred from the sixth railway project) and the Tae Baeg line (about 107 km). The CTC installation on the Dae Gu line, which was included in the sixth railway project, has been deferred to the next plan period. The above deferrals were agreed with the Bank. The Gyeong Bu line has an automatic block system while on other lines electric interlocking or token block systems are used. For safety, an automatic train stopping system is being installed.

Motive Power and Rolling Stock

2.13 KNR's motive power and rolling stock fleet at the end of 1979 is given in Tables 2.3 and 2.4. The fleet consists of 406 diesel and 90 electric locomotives (with about 10 steam locomotives still on shunting duties), 120 diesel rail cars, 252 electric railcars (on the Seoul urban electrified lines), about 1,815 passenger cars, and about 16,000 freight cars (including about 1,600 privately-owned cars). Another 10 diesel locomotives, 37 electric railcars, 246 passenger cars and 1,520 freight cars (of which 100 privately owned) have been ordered for delivery in 1979/80. An additional 10 diesel locomotives, 12 diesel railcars, 146 electric railcars (of which 130 for SMESRS), 246 passenger cars and 100 freight cars are included in the project.

2.14 Under the Sixth Railway Project KNR agreed to: (a) furnish to the Bank for review a plan to improve: (i) the maintenance; and (ii) the utilization of KNR's locomotives and rolling stock; and (b) implement such plan thereafter in consultation with the Bank. The plans have been submitted to the Bank and are being implemented, resulting in improved availability and utilization (see para 2.28).

Workshops

2.15 At present, KNR has main workshops at: Seoul (electric locomotives, diesel and electric railcars, passenger cars and freight cars), Yeongdeungpo (steam locomotives, passenger cars and freight cars), Incheon (passenger cars and freight cars), and Busan (diesel locomotives, passenger cars and freight cars). Steam locomotives are expected to be completely phased out by 1981. A new rolling stock workshop is being constructed at Daejeon; the freight car shop is just completed and the passenger car shop is expected to be in use by 1981. Some additional subsidiary shops at Daejeon are included in the project. KNR is planning to transfer all passenger and freight car maintenance to the new workshops at Daejeon and, by 1981/82, to close the existing workshops at Yeongdeungpo and Incheon after transferring usable equipment to other workshops. Provision is also made in the project for necessary improvements to remaining running sheds.

Telecommunications

2.16 The telecommunication system is in general satisfactory. Some further improvements of station-to-station and station-to-train communications are included in the project.

Freight Terminals

2.17 Due to rapidly increasing traffic there are difficulties handling the freight at the existing stations in the Seoul area. KNR, therefore, has developed a plan for the construction of new freight terminals near Seoul. The first two of these terminals, at Bugog south of Seoul, and Susaeg west of Seoul, were included in the Sixth Railway Project. At Bugog some preparation

study, carried out by Korea Institute for Science and Technology (KIST), are available. The Susaeg terminal is now deferred to the proposed project.

Other Property

2.18 In general, buildings, stations, offices and general plant of the railways are reasonably maintained.

Traffic

Freight Traffic

2.19 KNR's freight traffic statistics from 1966 to 1979 and forecasts to 1986 are given in Tables 2.5 through 2.7 and illustrated on Chart 20993. Freight traffic has grown at average annual rates of 6.7% in tons and 6% in tons-km since 1966. Major commodities which contributed to these increases were coal and cement. Coal transport by rail increased from 10.5 million tons in 1966 to 18.0 million tons in 1979, and cement from 1.7 million tons to 11.2 million tons during the same period. In 1979, freight traffic was 50.9 million tons and 11.1 billion ton-km, the average transport distance was 218 km. Freight net ton per route km averaged 3.0 million in 1979. Freight densities (see Chart 21015) are highest on KNR industrial lines between Seoul and the northeast region of coal mines and cement plants, exceeding 13 million tons on the heaviest section. The net highest freight densities are on the Jung Ang line south of Jecheon and on the Seoul-Busan line, with the busiest sections carrying around 4 million tons annually.

2.20 Bulk commodities best suited for rail transport - such as coal, cement, ore, oil, fertilizer, and grain accounted for 77% of KNR's total freight ton-km in 1979, up from 69% in 1966. Apart from some military and KNR's own transport, the remainder consists mainly of general cargo. Tonnage of this carried by KNR since 1966 has fluctuated between 4.5 million and 6 million tons p.a., reacting to factors such as the opening of the Seoul-Busan expressway in 1970 (much of the general cargo originally carried by KNR was suitable for highway transport), and the economic slowdown in 1975.

2.21 Past freight traffic forecasts have all been too optimistic with the exception of the forecast in the Fourth Project (Loan 863-KO) of 1972 which followed the traffic downturn in 1971 and 1972 (Chart 20993). Despite this past experience, lengthy discussions developed between KNR and the Bank during the appraisal of the Sixth Project in 1977 about the need to take a more conservative approach for the future and the forecasts made in 1977 are running about 8% above actual traffic in tons and 10% in ton-km. The major shortfall is on coal where the ambitious production target set earlier by Government has not been met.

2.22 For the future, a more conservative growth between 3% and 5% p.a. in ton-km has been assumed and detailed forecasts by commodities for high, low, and best estimates are given in Tables 2.5 to 2.7. The best estimate shows freight traffic reaching slightly over 65 million tons and 14 billion ton-km by 1986, with the basic composition of the traffic remaining unchanged, except for the emergence of more container traffic. These forecasts were agreed with KNR during the appraisal and appear realistic.

Passenger Traffic

2.23 Tables 2.8 through 2.10 show KNR's passenger traffic statistics from 1966 to 1979, as well as forecasts to 1986. Significant changes occurred in the last ten years which greatly affected passenger traffic. They were the opening of expressways in 1970-71, followed by the development of longdistance bus transport; the rise in personal incomes, which increased mobility and the demand for greater comfort, resulting in a shift to the higher class trains; and, finally, the opening in 1974 of the first Seoul subway line connected to KNR's electrified suburban lines.

2.24 Regarding long-distance travel, passenger traffic grew regularly until 1969, when it reached 115 million passengers and 9.7 billion pass-km. Due to sharp bus competition, particularly following the opening of the Seoul-Busan and the Daejon-Gwangju expressways, the number of long-distance passengers fell to 85 million in 1971. By 1973, however, passengers and pass-km were back to their 1969 levels, and both have been growing steadily since then, despite the 1974-75 economic slowdown. In the first three years of the FFYP, 1977 to 1979, the number of long-distance passengers increased 25% and at the end of 1978 it reached the level forecast for 1981 of 156 million.

2.25 As mentioned above, the growth in long-distance passenger traffic has been paralleled by a shift from lower class (ordinary) trains to limited express and special express. The number of passengers on express trains increased fivefold in the last five years, while the number of ordinary passengers remained almost constant (Table 2.9). Regarding suburban lines in the Seoul metropolitan area, SMESRS passenger traffic grew rapidly from the start of service in 1974 and exceeded 240 million passengers in 1979.

2.26 Contrary to freight forecasts, passenger forecasts have systematically been exceeded by actual traffic (Chart 20992). The developments referred to above make forecasting extremely difficult. To illustrate the point, the number of special express passengers doubled between 1975 and 1978 and limited express passengers more than tripled during the same period, while the number of ordinary passengers only increased by 5%.

2.27 For the future, annual growth rates between 5% and 7% in passengers and between 7% and 10% in passenger-km have been retained, on the assumption that GNP would continue to grow at around 7% to 8% p.a. over this period, and that the Government would continue to maintain a restrictive policy on the ownership and use of private cars. Detailed forecasts by types of service for high, low and best estimates are given in Tables 2.8 to 2.10. the best estimates show the number of intercity passengers reaching 268 milion in 1986 with about 30 billion passenger-km. In the absence of a comprehensive urban transport study covering the entire metropolitan area, forecasts of Seoul suburban traffic are difficult. KNR's forecast of over 760 million passengers on its suburban lines in 1986 appears reasonable.

Operations

2.28 Table 2.11 gives a summary of KNR's operating statistics for 1971-79. Operating efficiency remains high and in general continues to improve; some examples are given in the following table.

Table 2.01: SUMMARY OPERATING STATISTICS

	1971	1979	Index 1979 (1971=100)
Average number of passengers per passenger train	358	515	144
Average freight train load (tons)	441	491	111
Traffic units per employee ('000)	379	808	213
Availability (%)			
Diesel locomotives	82.8	89.7	108
Passenger cars	85.0	91.1	107
Freight cars	89.5	94.0	105
Passenger-km per available passenger car ('000)	5,722	11,018	193
Net ton-km per available freight car ('000)	601	727	121

Further improvements are possible only to a limited extent. Operational forecasts are defined in para. 3.18.

Tariffs and Costs

2.29 The following table gives unit average operating costs, revenues and net operating revenue comparisons for the years 1973-1979.

Table 2.02: AVERAGE UNIT OPERATING COSTS AND REVENUES
(Won)

Year	Freight			Passengers		
	Operating cost per ton/km	Revenue per ton/km	Net operating revenue (loss) per ton/km	Operating cost per pass/km	Revenue per pass/km	Net operating revenue (loss) per pass/km
1975	4.05	3.34	(0.71)	2.93	3.53	0.60
1976	5.76	4.64	(1.12)	3.69	3.67	(0.06)
1977	6.45	5.94	(0.51)	4.15	4.31	0.16
1978	7.21	6.49	(0.72)	4.31	4.85	0.54
1979	8.42	6.73	(1.69)	4.96	5.63	0.67

While freight suffered a loss every year, passenger traffic generated a profit every year except in 1976 when it incurred a small deficit.

2.30 Table 2.12 gives cost data for 1979. The table shows that the sizeable net operating revenue generated by passenger traffic, for which the operating ratio is expected to reach a low of 88%, stems from special and limited express passenger services while regular, ordinary express and commuter train services, and baggage services are operated at a loss. Ordinary express and baggage service tariffs cover total variable costs but only 70% of overheads while regular and commuter train tariffs cover only 93% and 46% respectively of variable costs. All freight tariffs cover full variable costs but only cement and ore contribute fully to overheads. The lowest contribution to overheads is generated by fertilizer tariffs (5%).

2.31 Although average fully distributed operating costs per freight ton/km doubled and corresponding costs per passenger/km increased by about 69% between 1975 and 1979, the respective costs of Won 8.42 (US¢ 1.24) per ton/km and Won 4.96 (US¢ 1.02) per passenger are still low. This is due to a high degree of utilization of rail facilities and rolling stock, low salaries and wages and high staff productivity. KNR's profitability therefore depends on the adequacy of tariffs.

2.32 KNR's tariffs are uniform throughout the system and are regulated by the Government. In the past, the latter has only reluctantly permitted KNR to raise its tariffs, mainly for social reasons. The following table shows average tariff increases implemented by KNR since 1975:

Table 2.03: AVERAGE KNR TARIFFS INCREASES SINCE 1975

	Freight (%)	Passenger (%)
1975 July	10	20
1976 January	35	-
1977 January	12 /a	-
1978 June	15	19
1979 May	10	15
1980 January	20	20

/a Result of reclassification.

Between 1975 and mid-1978, the Government, mainly under Bank pressure, permitted KNR to increase freight tariffs at a faster rate than passenger fares. However this trend was reversed in 1978-79 with the result that the average deficit per freight ton/km rose from Won 0.51 in 1977 to Won 1.26 in 1979. This shows the inadequacy of KNR's tariff policies.

2.33 KNR's tariff policies should take into account the following criteria:

(a) the ability of tariffs to provide sufficient revenue to cover all costs, including a fair return on invested capital;

(b) the ability of the tariff structure to effectively encourage productive use of the transport service and discourage wasteful or less productive use; and

(c) where competing modes of transportation exist, the tariff structure should also encourage utilization by each user of the most cost-effective transport mode. This is particularly important in view of the continuous increase in the cost of energy.

2.34 To meet these criteria, KNR's tariff structure needs to be revised to make sure that:

(a) it provides KNR with revenues sufficient to cover all operating costs including depreciation provisions based on fixed assets revalued annually plus the rates of return specified in para. 5.17; and

(b) no single tariff would be lower than KNR's variable costs unless the Government subsidizes the difference between variable costs and the actual tariff.

During negotiations, the Government agreed to make progressive changes in KNR's tariff structure, starting with the next tariff increase, in order to achieve the goals above no later than December 31, 1984.

Budget, Accounting and Audit

Budget

2.35 In compliance with the provisions of Section 3.02 of Loan Agreement 1542-KO (Sixth Railway Project) KNR has been allowed to submit its budgets in a commercial form starting in 1979 and given flexibility in reallocating operating budget funds as necessary to handle changes in traffic demand. The Government has not, however, granted KNR the freedom to fix the emoluments of its staff. Expenditures under the Investment budget are still rigidly controlled against budget provision by the Government's Office of Audits. The proposed change in KNR's status (para. 2.03) implies that KNR be given the freedom to fix salaries and to reallocate all budget funds; this would allow KNR to attract and retain qualified staff, and to react quickly to changes in traffic demand. The Government's plan for implementing this change was agreed at negotiations (para. 2.04).

Accounting

2.36 Work on implementing the computerized commercial accounting system, devised by consultants under the Fourth Railway Project in 1975-76, is still under way. The late start in implementing the system was caused by KNR's inability to recruit sufficient qualified and experienced accounting staff with computer experience. In addition, when the management study consultants (paras. 2.02 and 2.03) reviewed implementation of the system, they found that KNR staff, who had attempted to complete implementation of the system after departure of its originators in 1977, had had difficulties in understanding the system. Nevertheless, significant progress has been made in 1979 with the assistance of the management study consultants. However, KNR will need further help in updating the system and completing its implementation. The foreign cost of this assistance will be financed under the technical assistance component of the proposed loan.

2.37 This assistance will also help KNR to update and complete implementation of the traffic costing system. The management study consultants found that while the basic principles used for devising the system are sound, detailed suggested calculations, formulas and factors may no longer be valid within the framework of KNR's improved accounting and statistical procedures. In addition, the system needs to be revised to provide data for incremental variable costing.

Audit

2.38 The auditing of KNR's accounts by auditors satisfactory to the Bank is now carried out regularly. The audit reports for 1976, 1977 and 1978 were received within six months of the end of the fiscal year. During negotiations, the time allowed to produce the audit report for the Bank was extended from the present five months to six months after the end of each fiscal year.

3. INVESTMENT PLAN AND PROJECT

Project Objectives and Relation to the Sector

3.01 The proposed project would be the Bank Group's seventh lending operation to KNR which has received $340 million in loan and credit since 1962 to assist its modernization and expansion. The objectives of the project are directly focused on the goals set jointly with Government for Bank involvement in the sector (paras. 1.03 to 1.05), namely to increase capacity of the transport system in a most economically efficient way to develop and strengthen the institutions dealing with the transport sector.

3.02 Although the railway has lost its predominant position it remains the most economic mode of moving bulk commodities to inland destinations. It plays a particularly important role for the movement of coal in an energy-short economy, and also for the distribution of cement, ore, oil, fertilizer and grains. The analysis conducted since the sixth project also indicated that KNR has an economic, as well as energy saving role to play in the increasing movements of containers in the Seoul Busan corridor. The Bank's continuous involvement will lend support to KNR in playing its appropriate role in container transport.

3.03 Over the past three to four years, the combination of increasing incomes and the Government policy of restricting the ownership and use of private automobile has led to sharply increasing demand for the more comfortable and faster train services. The number of passengers transported in the intercity express trains quadrupled between 1974 and 1979. KNR has done its best to accommodate this demand, but capacity is strained. Rolling stock financed under the sixth project is now coming on stream, but demand continues to increase faster than supply. The forthcoming project offers an opportunity to the Bank to support two essential Government policies: (a) to hold down the use of private automobile by continuously improving public transport both for long distance and urban passenger services; and (b) to structure the country's physical development, focusing on five cities: Daejon, Daegu, Masan, Gwangju and Jeonju, by improving passenger train service to these cities from Seoul and Busan. Recent analyses also indicate that with the high occupancy of passenger trains experienced in Korea, trains consume less fuel per passenger than expressway buses on the long distance routes such as Seoul-Busan.

3.04 Apart from providing the financial resources to cover a decreasing portion of KNR's capital expenditures (30% of 1978/79 requirements through the sixth project and about 15% of the 1980/81 requirements through the proposed project), the Bank has been closely associated with the formulaton of KNR's investment plans and measures which have made KNR one of the most efficiently operated railroads in the world. Continued Bank assistance on these matters is sought both by the Government and KNR. Despite great progress in operations, KNR still needs assistance in planning and management. Invariably, project preparation by the Bank have resulted in substantial revisions in the size and phasing of investments. In the course of preparing this,

project with KNR, the mission suggested reductions of investment of about US$160 million or about 20% of KNR's original proposal. The point is that KNR is highly receptive to the Bank's review of its investment plan exercises and will continue to rely on and benefit from them until in-house planning capacity can be strengthened sufficiently. Because of the shortage of qualified transport specialists in Korea and the constraints of KNR's salary structure in recruiting and retaining such qualified personnel, the problem will remain in the medium-term and particularly for the preparation of the next five-year plan 1982-86. In the interim, the Bank should continue to provide KNR and Government with the required advice and guidance in investment planning.

3.05 To remedy KNR's shortcomings in investment planning and other commercial, financial and managerial aspects, a management study was carried out in 1979. KNR will need assistance for the full implementation of the study recommendations and in particular to complete its commercial and cost accounting system. The system was developed a few years ago by consultants but its implementation has been plagued by a variety of problems; difficulty of understanding the instructions partly because of a deficient translation, rapid turnover to staff who are attracted by higher salaries in a very competitive private sector, less than full support from higher management who feel uncomfortable with the changes, etc. Again here, the Bank should continue to provide support and guidance which some of the managerial improvements are being made and in particular a reliable costing system is implemented and fully operational.

3.06 While the financial objectives agreed between the Bank, the Government and KNR are gradually reached, KNR is not yet at a stage where it could borrow on the international capital market and therefore, Bank's financial contribution, although reduced as indicated in para. 3.04, is still needed. The less favorable macroeconomic situation of Korea in 1979 and 1980 with renewed balance of payment deficits is another reason for continuous lending to KNR, which runs a top quality operation and can make use of the funds both quickly and efficiently. It is expected that the sixth project of 1978 will be completed by mid-1981, about six months earlier than originally scheduled.

KNR's Investment Plan 1977-81

3.07 During the appraisal of the Sixth Railway Project in 1977, agreement was reached between the Government and the Bank on KNR's 1977-81 Investment Plan totalling W 503 billion (US$1,037 million) with a foreign exchange component of W 211 million (US$436 million). This Plan was later revised taking into consideration:

(a) larger price increases than expected, mainly for local currency items;

(b) additional works and equipment, mainly (i) doubling of the Chung Bug line, (ii) expansion of the Bugog freight terminal, (iii) improvement of station facilities on the SMESRS lines,

and (iv) additional rolling stock to meet the higher than forecast passenger traffic demand (180 electric railcars, of which 164 are for SMESRS, 12 diesel railcars and 92 passenger cars);

(c) deferment of works to 1982 and later, mainly (i) electrification of the Jecheon-Yeongju (64 km) and Seoul-Susaeg sections (8.5 km), (ii) extensions of marshalling yards at Jecheon and Deogha, and (iii) CTC on the Dae Gu line;

(d) reduction in provision of concrete sleepers (from 800,000 to 220,000), points and crossings (from 980 to 530) and ballast (from 640,000 to 95,000 cu m);

(e) reduction in motive power and rolling stock by 2 diesel and 6 electric locomotives, and 460 freight cars; mainly due to a lower than the forecast freight traffic increase; and

(f) devaluation of the Won against the US$ effective January 15, 1980.

3.08 The composition and cost of the revised plan, as now agreed between the Government and the Bank, are shown in detail in Table 3.1, a summary of which is given below. The Plan as now drawn up assumes continued high and further improving operational efficiency (see para. 3.23).

Table 3.01: KNR 1977-81 INVESTMENT PLAN

	----- W billion -----			----- US$ million-----			% of total expenditures
	Local	Foreign	Total	Local	Foreign	Total	
New line construction	18.16	-	18.16	33.53	-	33.53	2.2
Electrification	1.21	0.03	1.24	2.50	0.06	2.56	0.2
Increase in station & line capacity	243.10	21.86	264.96	457.43	38.59	496.02	33.2
Way & structures	44.14	22.35	66.49	83.60	42.06	125.66	8.4
Motive power & rolling stock	114.98	138.64	253.62	214.25	263.35	477.60	31.9
Motive power & rolling stock repair facilities	44.28	5.06	49.34	79.81	9.12	88.93	5.9
Miscellaneous	29.21	6.72	35.93	54.59	11.95	66.54	4.5
Subtotal	495.08	194.66	689.74	925.71	365.13	1,290.84	86.3
Contingencies (physical & price)	101.58	17.46	119.04	175.13	30.11	205.24	13.7
Total	596.66	212.12	808.78	1,100.84	395.24	1,496.08	100.0

3.09 The timing of investments in the agreed plan is shown below:

Table 3.02: TIMING OF FIVE YEAR PLAN INVESTMENTS

	W billion			US$ million		
	Local	Foreign	Total	Local	Foreign	Total
Investments starting in 1977 or before	85.36	26.44	111.80	173.24	54.52	227.76
Investments starting in 1978-79 (Sixth Railway Project)	254.13	95.74	349.87	484.20	185.65	669.85
Investments starting in 1980-81 (Seventh Railway Project)	257.17	89.94	347.11	443.40	155.07	598.47
Total	596.66	212.12	808.78	1,100.84	395.24	1,496.08

The Project and the Proposed Loan

3.10 The project to be financed under the proposed loan consists of investments in (i) KNR's plan intended to start in 1980 and 1981; and (ii) training and technical assistance for the Government (Table 3.2). Total cost of the project is estimated at W 350 billion (US$604 million) with a foreign exchange component of about US$161 million of which US$94 million would be covered by the proposed loan. A summary of the estimated project expenditures and items to be financed by the proposed loan is given in the following table:

Table 3.03: PROJECT COST
(US$ million)

	Total project cost			Proposed
	Local	Foreign	Total	loan
KNR Investments Starting in 1980/81				
New line construction (industrial sidings)	12.64	-	12.64	-
Increase in station and line capacity	131.70	30.19	161.89	-
Way and structures	37.10	18.35	55.45	18.35
Motive power and rolling stock	110.16	68.65	178.81	53.85
Motive power and rolling stock repair facilities	19.42	3.22	22.64	2.08
Miscellaneous (including telecommunications power facilities, housing and hospitals, technical assistance and training)	14.05	8.05	22.10	1.90
Subtotal	325.07	128.46	453.53	76.18
Contingencies (physical and price)	118.33	26.61	144.94	12.02
Total KNR	443.40	155.07	598.47	88.20
Training and technical assistance for Government	-	5.80	5.80	5.80
Grand Total	443.40	160.87	604.27	94.00

3.11 The proposed loan would cover acquisition of some rails, permanent way equipment, all the new breakdown cranes, passenger cars and freight cars included in the project, and provision of technical assistance and overseas training (Table 3.3). The remaining foreign currency items, including rails, signalling equipment, new diesel locomotives, remodeling of diesel locomotives, workshop equipment, hospital equipment and research equipment, would be financed by other agencies (see para. 3.21).

Description of Main Project Items

New Line Construction

3.12 New line construction comprises only two new industrial sidings.

Increase in Station and Line Capacity

3.13 Major items under this category are:

(a) Completion of the quadrupling of the section Seoul-Suweon (32.3 km) of the Gyeong Bug line, mainly to carry increased suburban traffic;

(b) Expansion of the West Seoul freight terminal at Susaeg, mainly for improved handling of coal, cement and containers; and

(c) Installation of centralized traffic control system (CTC) on the Jung Ang line between Yeongju and Gyeongju (about 163 km) and on the Tae Baeg line (about 107 km).

Way and Structures

3.14 The main components are:

(a) Rail renewal on about 210 km of track and complete track renewal on about 110 km of track (see Tables 3.4 and 3.5);

(b) Provision of about 70,000 concrete sleepers, about 200 points and crossings and about 70,000 cu m of ballast;

(c) Bridge and tunnel strengthening, right-of-way improvements (stabilization of soils, drainage work, anti-erosion measures etc.);

(d) Separation of road and rail at level crossings when road/rail traffic densities reach levels set by Government; and

(e) Track maintenance equipment and track material workshop equipment (Table 3.6).

Motive Power and Rolling Stock

3.15 The main project items are:

(a) Provision of 10 main line diesel locomotives, 12 diesel and 16 electric railcars for intercity traffic and 130 electric railcars for SMESRS (calculated according to traffic forecasts, Annex 4, reference C-3, Table 1 and 2); provision of two breakdown cranes; and repowering/repair of 40 diesel locomotives, 40 diesel railcars and 40 heating cars;

(b) Provision of 20 special express cars and 226 limited express passenger cars (calculated according to traffic forecasts, Annex 4, reference C-3, Table 3); remodeling of older existing cars for use as ordinary passengers and baggage cars; and

(c) Provision of 100 container cars (calculated according to traffic forecasts, Annex 4, reference C-3, Table 4); remodeling of freight cars for use as cabooses.

Motive Power and Rolling Stock Repair Facilities

3.16 This part of the project comprises the following items:

(a) Provision of subsidiary shops (machinery shop, electric shop and coupler shop) for the new Daejon passenger and freight car shops; and

(b) improvement to existing workshops and running sheds (equipment listed in Table 3.7).

Telecommunications, Power Facilities and Miscellaneous

3.17 Items included are:

(a) Further improvement to telecommunications and power supply;

(b) Relocation of the railroad school from Central Seoul to Bugog, construction of housing for employees and provision of hospital equipment; and

Technical Assistance and Training (KNR)

3.18 This includes:

(a) implementation of recommendations in the management study carried out under the Fifth Railway Project (an outline terms of reference for such technical assistance is given in Annex 1); and

(b) provision of overseas training.

Studies and Training (Government)

3.19 This part of the project to be carried out by various Government agencies including EPB, MOT and MOC comprises:

(a) feasibility studies of investments in the next five year plan period 1982-86 upon completion of the national comprehensive transport study now under execution by consultants KIST, and financed under the Sixth Railway Project;

(b) urban transport studies in the metropolitan areas of Seoul, Busan and a few other cities; and

(c) training of Government staff in transport planning and coordination.

Cost Estimates

3.20 Project costs are based on estimated prices at the end of 1979 (Annex 4, reference C-3, Table 5). The cost of technical assistance is estimated at about US$4,000 per man-month of local staff and US$11,000 per man-month for expatriate staff; out of which about US$2,000 are for foreign and local travel and local subsistence. Physical contingencies of 5% in 1980 (since quantities are more precisely known) and 10% in 1981/82 have been included for all items except rail and track renewal and motive power and rolling stock. Price contingencies have been included for all items; assumed price increases for local currency items are 25% annually in 1980, 15% in 1981 and 10% in 1982; and for foreign currency items 10.5% annually in 1980, 9% in 1981 and 8% in 1982. Contingencies, physical and price, on all items taken together represent about 24% of project cost (Table 3.03).

Financing Plan

3.20 Proposed financing of the foreign currency part of the project is given in Table 3.8 and summarized as follows:

Table 3.04: PROJECT FINANCING PLAN: FOREIGN COMPONENT

	Amount including contingencies (US$ million)	Percent
KNR		
IBRD Loan	88.2	55
US Export-Import Bank	8.0	8
Overseas Economic Cooperation Fund (Japan) or other foreign source	5.0	
Korean Foreign Exchange or other foreign source to be negotiated	38.0	23
Korean Exchange Bank (KFX) - purchase by KNR	15.8	10
Total KNR	155.0	96
Government		
IBRD Loan	5.8	4
Grand Total	160.8	100

The local component of the project would be financed as follows.

Table 3.05: PROJECT FINANCING PLAN: LOCAL COMPONENT

	W billion	US$ million	Percent
KNR	42.2	72.7	17
Government equity	13.6	23.5	5
Loan provided by the Korean Development Bank	201.4	347.2	78
Total	257.2	443.4	100

Project Implementation

3.22 KNR will be responsible for implementation of the project except for the transport sector feasibility studies, the urban transport studies and training of Government staff which will be directed by MOT, MOC, and EPB. A project execution schedule and a procurement schedule for Bank financed items are given in Tables 3.9 and 3.10. Monitoring of progress based on these schedules will be further discussed during supervision. KNR's performance in executing the six previous projects has been in general satisfactory.

Operational Forecast

3.23 The calculation of motive power and rolling stock requirements during the project period is based on traffic forecasts given in Tables 2.5 through 2.10 and the following operational forecast:

Table 3.06: OPERATIONAL FORECAST

	Actual	Forecast			
	1978	1979	1980	1981	1982
Availability of rolling stock (%)					
Main line locomotives, diesel	88.2	88.4	88.7	90.0	90.0
Main live locomotives, electric	89.9	90.0	90.0	90.0	90.0
Passenger cars	91.2	91.5	91.8	92.1	92.3
Freight cars	93.1	92.6	93.0	93.0	93.0
Locomotive - km per available main line locomotive ('000)					
Diesel, passenger trains	212	213	214	215	216
Diesel, freight trains	114	115	116	117	118
Electric, passenger trains	178	185	192	200	204
Electric, freight trains	108	110	112	114	116
Passenger car - km per available passenger car ('000)					
Special express cars	230	235	240	245	249
Limited express cars	242	245	250	255	260
Turn-around time for freight cars (days)					
Box cars	5.23	5.1	5.0	4.9	4.8
Gondolas	4.22	4.2	4.2	4.15	4.15
Flat cars	8.10	8.0	7.8	7.6	7.4
Tank cars	4.50	4.45	4.4	4.35	4.3
Container cars	2.41	2.4	2.4	2.4	2.4
Average car load per loaded car (tons)					
Coal	46.2	46.6	47.0	47.4	47.8
Cement	46.3	46.6	46.9	47.2	47.5
Ore	44.9	45.2	45.5	45.8	46.1
Oil	41.0	41.1	41.2	41.3	41.4
General cargo	40.3	41.0	41.5	42.0	42.5

Procurement

3.24 Government procurement of equipment and material in Korea is handled by the Office of Supply (OSROK). All items to be procured under the proposed loan will be subject to international competitive bidding, in accordance with Bank guidelines. In bid evaluation, Korean manufacturers of equipment will be allowed a preferential margin of 15% of the c.i.f. cost of competing imports, or the relevant prevailing level of customs duties, whichever is lower. Equipment financed by US Export-Import Bank will be procured through negotiated contracts; for other items financing agency's guidelines will apply. Civil works contracts will be awarded by KNR after local competition among prequalified bidders.

Disbursements

3.25 Disbursements would be made as follows:

(a) 100% of the c.i.f. cost of imported equipment and materials; and/or

(b) 100% of the ex-factory cost of locally manufactured equipment and materials if local bidders are successful;

(c) 100% of cost of technical assistance; and

(d) 100% of foreign cost of overseas training.

Any savings under the loan would be used for financing additional, but similar, project items, subject to review and agreement with the Bank.

3.26 An estimated schedule of disbursement is given in Table 3.11. Disbursements are based on the assumption that the proposed loan would become effective by July 15, 1980.

4. ECONOMIC EVALUATION

General

4.01 KNR continues to play a vital role in the economy of Korea. Although road transport and coastal shipping have increased their share over the last decade (para. 1.02), the railway remains the most economic mode of moving bulk commodities to inland destinations. The line haul costs are only a fraction of road costs and, while coastal shipping costs are competitive with rail costs on a ton-km basis, the circuitous sea routes often give rail the advantage. The traffic forecasts given in Chapter 2 have taken into consideration competition from other modes, particularly

coastal shipping, for bulk movements of commodities from coastal plants. However, for coal and most cement, which account for over 50% of railway ton-km, the major production areas are inland. It is imperative that rail capacity is sufficient to handle this traffic, which is vital for the country's continued development.

4.02 The combination of increasing incomes and the government policy of restricting the use of private automobiles has led to a sharply increasing demand for the more comfortable and faster passenger train services. As noted in para. 1.07, Koreans own fewer automobiles then citizens of other countries despite a relatively high per capita income. For long distances of 300-400 km express trains are more comfortable, safer and faster than highway buses, and also compete favorably with air travel, as the fare is half the airfare and travel time comparable, taking into account transport time between airports and city centers. In view of this, the development of express train services to satisfy the rapidly increasing demand is justified particularly since these are KNR's most profitable services. Operating ratios for the special and limited express services were, respectively, 37% and 43% in 1979. Traffic forecasts are given in Chapter 2.

Benefits and Economic Returns

4.03 The original KNR Investment Plan for 1977-81 was analyzed as a whole during the appraisal of the Sixth Railway Project (Loan 1542-KO) in 1977-78. Investments starting in 1980 and 1981, which form the proposed project, are analyzed below.

4.04 The economic evaluation focuses on project investments globally, and on particular items whenever possible. Table 4.1 shows project investments classified for the purpose of economic analysis. The larger group, accounting for nearly half of all project costs, consists of investments which are primarily geared to increase railway capacity to carry types of traffic for which rail transport is the most economic. The second group, amounting to 30% of project costs and also consisting of capacity-increasing investments, is for suburban passenger services in the Seoul Metropolitan Area. The remaining project items are way and structures renewal (10%), and miscellaneous investments (13%).

Capacity Increasing Investments (Intercity Services)

4.05 These investments are fixed installations on the lines and stations, and motive power and rolling stock. The latter, which can, of course, be used more flexibly throughout the network has a lower risk factor than line installations. Consequently, line capacity investments have been very carefully analyzed on a line-by-line basis. Ways to increase estimated existing capacity through improved operations has been reviewed. KNR

retained consultants (KDA Korea/Wilbur Smith Associates USA) for the technical and economic feasibility analysis of major investments to be included in the projects, the results of which have been used partially for this report. As a result of discussions during project preparation capacity-increasing investments were reduced by about US$160 million or about 20% of KNR's original proposal.

4.06 Capacity in motive power and rolling stock has been analyzed on a network-wide basis. Possibilities for increasing operating performance were considered , such as increasing train-km for locomotives, lowering turnaround times and increasing loadings and distances traveled for wagons. For rate of return calculations, capacity-increasing investments have been allocated to freight and passenger services. This was done directly for freight and passenger cars, and for some fixed investments. For locomotives and joint fixed investments on lines - such as crossing loops, bypass lines and signalling - allocation was in proportion to the relative capacity provided for each service (Table 4.2).

4.07 Freight. The benefits of investments to increase the railway's capacity to carry freight traffic are measured in terms of transport cost savings for the overall economy, calculated as the difference between the economic cost of rail transport and the economic cost of the next best alternative mode. The major variables involved in the calculation of benefits are: (a) the amount of traffic that would be diverted to other modes based on the capacity of the railway with and without the project; and (b) the economic costs of transport by various alternative modes (Table 4.3). Alternative modes could be road, or a combination of either rail or road and coastal shipping. Rail traffic forecasts already reflect the share of coastal shipping when the latter has a definite economic advantage. For the remaining traffic, for which rail capacity is provided by the proposed project, coastal shipping is no longer a valid alternative, as it would involve long terminal transport at either end, requiring either rail capacity or higher cost road transport. Consequently, in this analysis, rail costs are compared to road costs, as the costs of using coastal shipping as a partial alternative are even greater than the all-road alternative. The economic benefits in terms of transport cost savings would yield an economic rate of return (ERR) of 33% (Table 4.4). This is a conservative estimate, since the amount of traffic that would divert to other modes without the project has been assumed at only two thirds of the traffic increase forecast between 1979 and 1982, with the remaining one-third to be handled by improvement in use of existing facilities. Assuming that only one-third of the traffic increase would divert to other modes without the project would reduce the rate of return to an acceptable 17%.

4.08 Passengers. The proposed capacity increases are for the better quality special and limited express trains services. The economic cost of

these services are becoming lower than bus costs because fuel costs have increased and rail services, when used to capacity as in Korea, consume less fuel per passenger-km than buses. Fares are substantially higher for special express (2.7 times) and for limited express (2.3 times) than either rail costs or bus fares (Table 4.5). The fact that people are ready to pay double the bus fare reflects the benefits they derive from express train travel, e.g. comfort, speed, safety, etc. Consequently, the benefits of increasing the capacity of the better passenger services are measured in terms of willingness to pay for the services over and above their costs. They are calculated as the difference between the cost of the services and their revenues, and give a return of 17% on the investment (Table 4.6).

Seoul Suburban Services

4.09 Urban development in Seoul, (over 7 million inhabitants) has spread beyond the city boundaries along the transport lines. The larger cities on the rail lines such as Incheon (800,000), Anyang (135,000) and Suweon (225,000) are growing rapidly and create, together with Seoul, an interconnected urban system of some 9 million people. Until 1974, urban transport consisted almost exclusively of buses and taxis. Because of the configuration of the center of Seoul, which includes large blocks penetrated by narrow streets suitable only for pedestrians and small delivery vehicles, traffic congestion on the major arteries is acute despite the very low rate of private car ownership.

4.10 In 1974, the first sections of a mass rail transit system were put into service, consisting of a 9.5 km underground line (Seoul City Subway) and 86 km of electrified existing KNR lines (Map 13135). The system (KNR SMESRS and Seoul City Subway) met with immediate success and passenger traffic, which was over 300 million in 1978, is increasing rapidly. Work has started on a second subway line in Seoul and is about to start on the proposed third and fourth lines. Meanwhile, KNR is upgrading about 63 km of existing lines with electrification and some double tracking to expand suburban services. The densities of urbanization in Seoul, present a good case for making the maximum use of existing rail infrastructure and right-of-way. Costs of upgrading existing rail lines are small compared to subway construction. However if maximum benefit is to be gained from the investment, it is necessary to analyze in detail potential transport demand in the corridors on which KNR proposes to expand service, to forecast traffic in relation to other modes, ensure the optimum location of stations, and establish priority and timing for construction of the various sections. An urban transport study which was to address these issues was completed in 1979 by Korean consultants KIST. Unfortunately it did not fulfill expectations; conclusions were limited to the city of Seoul and provided no information on suburban services. The Bank is planning an urban sector mission in 1980 to prepare future assistance to urban transport in Seoul and other cities in Korea, and subsequent urban transport studies are included in this project.

4.11 The project includes 130 electric rail cars to carry the expected increase in traffic; and continuation of the quadrupling of the line from Seoul to Suweon. This investment, started under the Sixth Project will enable KNR to separate urban from long-distance traffic on the most heavily (in number of trains/day) used section of the entire network. The population served by the Seoul-Suweon line is over half a million now and expected to about double by the early 1990s. The benefits of increasing service on existing lines are in terms of transport costs savings from the alternative mode, mostly buses, taxis and cars. The economic rate of return is conservatively estimated at 19% assuming that without the project all trips would be made by bus (Table 4.7). To carry the traffic that will be handled by the railcars included in the project, would require about 600 new buses or about 10% of the existing bus fleet in Seoul. The benefits thus calculated do not include the higher costs of some diverted trips which may be done by taxis or private cars, nor savings in road passenger time which would be affected by the increased congestion which extra buses would add to already congested streets.

Way and Structures Renewals

4.12 The main items in this category are rail and track renewal, including sleepers replacement and new ballast; the remainder of the cost is for strengthening of bridges and tunnels. While it is a general practice of railways to show way and structure renewal costs in their investment programs, the nature of these costs is more periodic maintenance than investment. Rail and sleepers have to be periodically replaced, and ballast has to be added in order to keep the trains operating safely at normal speeds.

4.13 KNR's network consists of 4,100 km of track. Some 930 km or 23% of the network have rails over 20 years old; another 880 km have rails between 10 and 20 years old. A broad indication of rail renewal timing is the number of gross tons which have passed over a given line section, but conditions will vary widely according to topography, aligment, and train types. Assuming, however, that the useful rail life is on average around 300 million gross tons, there would be some 1,000 km (24% of the network) of rail with a life of between 10 and 20 years, and another 250 km with a 20-30 year life (based on 1976 traffic volumes). For the rest of the network, rails would last up to 40 and 50 years. On the above assumptions, renewal should average about 140-150 km/year, increasing over time, according to traffic growth.

4.14 The rail and track renewal program agreed with KNR under the Sixth Project for implementation during the FFYP would cover the recurrent need and some of the urgently needed rail replacement in curves on the industrial lines. If this program were not carried out, the quality of the track would deteriorate, with the risk of increased accidents. Speed restrictions would gradually reduce capacity, particularly on single track lines which account

for most of KNR's network. Rates of return for the program calculated in the Sixth Project range from 20% to 32% with a weighted average of 27% (Annex 4, reference C-4).

Miscellaneous

4.15 This category, comprising some 13% of the project cost, all in local currency except for some technical assistance, includes numerous small investments throughout the network. The largest amount, about one-fourth, is for improving safety at rail and road crossings. This ranges from simple signalling, to level crossing barriers and grade separation where justified. The cost of these safety measures is shared equally between KNR and the Ministry of Construction (MOC), who jointly select the locations of these improvements according to established rules, based on respective levels rail and road traffic. Other items include improvement of existing workshops and sheds, relocation of lines to accommodate new industrial and urban developments, and general improvements to right of way, buildings, housing and training facilities, technical assistance and research.

Overall Economic Evaluation

4.16 The weighted average economic return on the capacity-increasing investments and on way and structure renewals is 22%.

Sensitivity and Risks

4.17 The main area of risk for railway projects is traffic forecasting. However, in Korea's rapidly growing economy even optimistic forecasts will be achieved within one or two years, and full project benefits delayed accordingly. For the purpose of sensitivity analysis, the ERRs of the capacity-increasing investments have been recalculated assuming the low estimate both for future freight and passenger traffic (Tables 2.5 to 2.9). Estimated costs for Korea railway projects have typically been realistic, or even on the high side, with funds remaining in previous loans after project execution. For the sensitivity analysis, the ERRs of the capacity-increasing investments have been recalculated with cost variations of $\pm$ 10%. The results of sensitivity analysis are given in the table below:

Table 4.01: ECONOMIC RATES OF RETURN
(percent)

Capacity-increasing investments	Best estimate	Sensitivity: Traffic growth low estimate	Sensitivity: Cost +10%	Sensitivity: Cost -10%
Freight	33	29	30	36
Passenger	17	16	15	19
Seoul Suburban Service	19	17	17	21

4.18 As expected, the impact of even substantially slower traffic growth on the rate of return is not large, since benefits are only postponed. Another risk which is impossible to quantify and time, is the effect of an easing of Government's policy of restricting private car ownership. Passenger traffic would certainly be negatively affected, however, the effect of increased car ownership would spread over a period of years and may be tempered by overall growth in transport demand. Since railway equipment has a long life (assumed at 25 years for the ERR calculation), it is important to closely monitor shifts in demand for rail services to avoid excess capacity.

5. FINANCIAL EVALUATION

Background

5.01 Part B of the proposed Project deals with studies and technical assistance initiated on behalf of the Government which will serve the relevant portion of the proposed Loan. Its implementation has no immediate financial impact. The following analysis consequently focusses on Part A of the Project, implementation of which will substantially affect KNR's future financial performance and situation.

5.02 KNR's financial objective is to generate operating revenues sufficient to cover operating expenses, debt service, and a reasonable proportion of the capital investments needed for fulfilling its role in Korea's transportation system. KNR's acounts showed small annual profits through 1969; however, these profits were overstated due to inadequate provision for maintenance expenditures and depreciation. Between 1970 and 1976 operating

revenues barely covered operating costs and KNR had to borrow for most of its investment requirements, which increased its debt service burden and further reduced available funds. The Government therefore had to provide KNR with increasing annual cash subsidies to cover its debt service. As passenger and freight traffic were heavy and KNR's unit costs low, the main reason for KNR's inadequate financial performance during 1970-76 was the Government's reluctance to permit necessary railway tariff increases.

5.03 The Sixth Railway Project aimed at assisting KNR to become financially viable by 1981 without Government subsidies and at the same time to implement an ambitious Won 197 billion (US$406.5 million) investment program. The following analysis reviews KNR's progress since the start of the Sixth Railway Project; determines a financing plan for the Seventh Railway Project and establishes the conditions under which the project can provide a rate of return sufficient to enable KNR to meet its financial goals.

5.04 The financial tables backing this analysis have been prepared in current Won under inflation assumptions listed in paras 5.16 and 5.20, so that KNR's liquidity position during implementation of both the proposed project and the Government's Fifth Five-Year Plan (1982-1986) can be realistically assessed. Tables showing breakdowns of operating revenues and working expenses have been prepared for the years following 1979 both in constant 1979 and current Won. All proposed targets are based on current prices. The analysis considers the three following periods: 1977-79 (prior to start of the proposed project), 1980-82 (project implementation) and 1983-86 (Fifth Five-Year Plan).

Past Financial Performance

5.05 Income statements for the years 1977 through 1979 are given in Table 5.1 and summarized below. Operating revenues working expenses, and depreciation provisions are summarized in Tables 5.2, 5.3, 5.4 and detailed in Annex 4, reference C-5, Tables 3 to 10. Table 5.8 gives selected financial ratios.

Table 5.01: SUMMARY INCOME STATEMENTS, 1977-79 (Won billion)

	1977	1978	1979 Estimate
Operating revenues	134.3	166.1	208.4
Less working expenses	119.3	142.8	184.0
Less depreciation	17.3	20.5	21.2
Net operating revenue (loss)	(2.3)	2.8	3.2
Less interest charges	16.3	23.8	29.2
Net revenue (loss)	(18.6)	(21.0)	(26.0)
Add net non-operating revenue	(1.4)	(1.3)	3.2
Net profit (loss)	(20.0)	(22.3)	(22.8)
Add government subsidies	21.7	21.4	21.8
Net income	1.7	(0.9)	(1.0)
Ratios			
Operating (%)	102	98	98.0
Interest charges coverage (times)	NA	0.1	0.1
Return on net fixed assets in use (actual) (%)	NA	0.3	0.3
Return on net fixed assets in use (required) under 6th project (Loan 1542-KO) %			2.9

Operating Revenue and Overall Results

5.06 The table shows that KNR operating revenues, which were insufficient to cover even operating expenses in 1977, have increased steadily and KNR would have been able to finance about 90% of its interest charges from its net operating revenue in 1979 if its passenger traffic had not collapsed during the last quarter of that year as a result of the country's political problems. This is mainly the result of two tariff increases authorized by the Government in compliance with agreements reached during negotiations of Loan 1542-KO. The first increase in June 1978, provided for an average 19% increase in passenger rates and 15% in freight rates, and the second, in May 1979, for 15% in passenger and 10% in freight rates. In 1979, freight traffic still operated at a net loss while passenger traffic generated a net profit, almost making up for the deficit on freight traffic.

Operating Expenses

5.07 Total working costs (Table 5.3) increased by about 20% per year in both 1977 and 1978, compared with previous years. This annual increase reached 29% in 1979 due mainly to increases of 59.2% in the cost of diesel fuel and 37.7% in the cost of electricity, effective July 12, 1979. The proportion of fuel costs to total costs increased from 13% in 1977 and 1978 to 16% in 1979, and is likely to continue growing. Staff salaries increased on average by about 20% in 1978 and 31% in 1979, comprising respective increases of 5 and 11% in real terms. This results in an increase in the proportion of staff costs to total costs from 53% in 1977 to 56% in 1979. The latter proportion is still low compared with most railways in the world and is an important factor in KNR's low operating costs. Depreciation provisions represent about 2.3% of fiscal assets in use in 1979, which is an acceptable proportion, given that it is based on revalued fixed assets.

Cash Flow

5.08 KNR's Cash Flow for 1977 through 1986 is given in table 5.5 and summarized below for 1977 through 1979:

Table 5.02: SUMMARY CASH FLOW, 1977-79

	1977	1978	1979 (estimate)	Total 1977-79
Sources				
Funds generated by KNR	16.6	28.2	35.8	80.6
Government subsidies (operations and investments)	22.5	21.4	49.2	93.1
Loan mobilization - Foreign loans	25.0	25.3	46.1	96.4
- Local loans	24.0	35.0	47.5	106.5
Subtotal	49.0	60.3	93.6	202.9
Total source	88.1	109.9	178.6	376.6
Applications				
Capital investments - Foreign	21.3	25.3	46.1	92.7
- Local	44.1	34.4	80.6	159.1
Subtotal	65.4	59.7	126.7	251.8
Debt service - Interest	16.3	23.8	29.2	69.3
- Repayments	15.0	19.5	25.5	60.0
Subtotal	31.3	43.3	54.7	129.3
Total applications	96.7	103.0	181.4	381.1
Annual Variation in Working Capital	(8.6)	6.9	(2.8)	(4.5)
Working capital brought forward	4.9	(3.7)	3.2	4.9
Working capital at end of year	(3.7)	3.2	0.4	0.4
Ratio: Debt service coverage (times)	0.5	0.6	0.7	

KNR's financial situation improved steadily as shown by the improvement of the debt service coverage ratio. However, due to the collapse of the profitable passenger traffic during the last quarter of 1979, KNR was short about W 19 billion to finance its debt service requirements from its cash generation and could not participate in the financing of its 1979 capital investments (W 126.7 billion). As all capital investments in foreign currency were financed from foreign loans (W 46.1 billion), KNR financed the rest of its debt service and the local component of capital investments from government subsidies (W 49.2 billion) and loans from the Korean Development Bank (W 47.5 billion). To cover the remaining W 2.8 billion gap KNR was obliged to practically exhaust its working capital.

5.09 KNR's balance sheets for 1977 through 1986, given in Table 5.6, are summarized below:

Table 5.03: SUMMARY BALANCE SHEETS, 1977-79
(Won billion)

	1977	1978	1979 (estimate)
ASSETS			
Current assets	29.2	42.9	45.8
Less current liabilities	32.9	39.7	45.4
Net working capital (deficiency)	(3.7)	3.2	0.4
Net fixed assets	846.6	916.7	1,043.2
Other assets	36.2	54.5	55.4
Total assets	879.1	974.4	1,099.0
LIABILITIES			
Long term debt	289.3	317.6	427.5
Equity equivalent	589.8	616.8	671.5
Total liabilities	879.1	974.4	1,099.0
RATIOS			
Current assets to current liabilities	0.9	1.1	1.0
Debt to equity	33/67	37/63	39/61

Working Capital

5.10 Under Section 4.04 of Loan Agreement 1542-KO, KNR was to reach a 1:5 ratio of current assets to current liabilities in 1979. Table 5.03 shows that KNR was far from meeting this target, and that its net working capital by the end of 1979 was practically drained out. It was consequently agreed at negotiations that the target date for reaching the above ratio would be set to December 31, 1983. In order to closely monitor KNR's liquidity position it was also agreed that KNR, assisted if necessary by the Government, should take all action required to attain by that same date and maintain thereafter (a) a cash balance of not less than 1/12 of labor costs of the previous twelve months, (b) accounts receivable of not more than 1/6 of gross receipts from freight transactions of the previous twelve months and (c) accounts payable of no more than 1/6 of fuel, materials and other operating expenses of the previous twelve months.

Fixed Assets

5.11 The valuation of KNR's fixed assets from 1978 through 1986 (Table 5.4) includes the effects of a global revaluation of fixed assets which KNR carried out in 1976 and of annual revaluations thereafter. KNR has agreed to continue revaluing its fixed assets on an annual basis in the future. Other assets consist mainly of accumulated exchange fluctuations which have been charged to the long-term debt account.

Long-term Debt

5.12 A close estimate of KNR's total debt outstanding at the end of 1979 is summarized as follows:

Table 5.04: KNR's LONG TERM DEBT

Type of Loan or Finance	Debt Outstanding Won Billion	Debt Outstanding US$ Million (US$1 = W 485)	Items Financed
50 cycles group (European consortium)	16.4	33.8	Electrification (locomotives and fixed equipment)
US Exim Bank	26.4	54.5	Diesel locomotives and engines
IDA credits and Bank loans	142.6	294.0	Miscellaneous equipment
KfW Germany	6.1	12.6	Signalling
OECF Japan	47.9	98.8	Miscellaneous equipment
US AID	3.2	6.6	" "
Suppliers credits	0.5	1.0	Spare parts
Total foreign finance	243.1	501.3	
Korean Development Bank and other domestic loans	176.4	363.7	Local expenditures and debt service.
Total	419.5	865.0	

The 39/61 long-term debt to equity ratio by the end of 1979 (Table 5.8) shows that KNR could substantially increase borrowing without endangering its long-term financial position. Since implementation of the Fourth Railway Project all Bank loan agreements included a debt limitation covenant which requires Bank agreement before KNR incurs any new long-term debt if

its net cash revenues are less than 1.2 times its maximum debt service requirement. KNR's previous cash revenues have not been sufficient to achieve this ratio and the outstanding debt has continued to grow with a consequent rise in debt service requirements. KNR's net cash revenues were still insufficient to achieve the ratio in 1979, obliging KNR to increase its borrowing from KDB to help finance its debt service (para. 5.07). To ensure that KNR's future liquidity position and debt service remains within an acceptable level the investment limitation covenant (Section 3.12 of Loan Agreement 1542-KO) should be re-affirmed at loan negotiations with a ceiling of W 20 billion instead of W 10 billion. The debt limitation covenant should also be re-affirmed. However, given KNR's easy present and anticipated long-term financial situation and its management's prudent borrowing policy, the 1.2 ratio can be reduced to 1.1.

KNR's Overall Financial Situation Before Project Commencement

5.13 Based on KNR's financial results during the first eight months of 1979, the Project's appraisal mission had anticipated that KNR's financial situation by the end of 1979 would show a marked improvement thanks to KNR's high operational efficiency in carrying fast growing passenger and freight traffic and to the implementation of relatively high tariff increases. The mission's anticipations did not materialize because of the collapse of long distance passenger traffic during the last part of the year and KNR's short term financial situation before project commencement was precarious. Further improvement in KNR's financial performance mainly through increased traffic and higher tariffs is necessary to increase KNR's participation in the financing of its investments and decrease its borrowing and dependence on Government assistance.

Financial Performance During Project Implementation

Funds Needed During the Period

5.14 The following table summarizes KNR's fund requirements for financing its 1980-82 working costs, capital investments and debt-service on outstanding loans and on the additional ones required for financing the proposed project. Details are in Tables 5.5, and in Annex 4, reference C-5, Tables 7 to 10, 12 to 14 and 16.

Table 5.05: KNR's FUND REQUIREMENTS DURING PROJECT PERIOD
(Won billion)

	1980	1981	1982	Total 1980-82
Working costs	258.2	321.9	387.0	967.1
Debt service on loans outstanding as of December 31, 1979	61.6	64.7	64.7	191.0
Capital investments:				
In foreign currency	37.6	57.9	67.4 /a	162.9 /a
(Won equivalent)				
In local currency	119.1	230.7	181.0 /a	530.8 /a
Total investments	156.7	288.6	248.4	693.7
Debt service on loans for 7th project	8.9	21.4	35.0	65.3
Debt service on loans for financing 1982-86 investment plan (Ref. C.5 Table 16)			6.5 /a	6.5 /a
Total fund requirements	485.4	696.6	741.6	1,923.6

/a Including start of tentative 1982-86 Investment Plan (foreign W 45.0 billion, local W 143.5 billion).

Funds to be Generated by KNR

5.15 Given Korea's shortage of foreign currency it is assumed that the Government will, as far as possible, borrow funds from abroad on KNR's behalf for financing the foreign component of its capital investments, and lend foreign currency to KNR if no foreign lender can be found. In addition, the Government has already agreed to provide equity for financing or partial financing of industrial and urban transportation related-investments. KNR's funding needs will consequently be reduced accordingly. Based on agreed traffic forecasts converted to revenues by applying December 31, 1979 tariffs, KNR's gross operating revenues would amount to Won 254.9 billion in 1980, 286.7 billion in 1981 and 321.5 billion in 1982. The Government has agreed to increase these revenues through selective tariff increases calculated to generate annual revenues 24% higher in 1980,/1 47% higher in 1981 and 57.5% higher in 1982 than those generated using December 31, 1979 tariffs. The remaining financing gap would be covered by additional borrowing from KDB, supplemented by Government subsidies when necessary.

5.16 KNR's basic financial statements, based on the best estimate traffic forecasts (paras. 2.19-2.27) and taking into consideration working and investment costs and debt service described in para. 5.14, and financing means explained in para. 5.15, are summarized as follows:

/1 20% by January 1, 1980 and an additional 8% by July 1, 1980.

Table 5.06: SUMMARY INCOME ACCOUNTS, CASH FLOW AND BALANCE SHEETS, 1980-82
(Won billion)

	1980	%	1981	%	1982	%
Income Accounts						
Operating revenues	316.2		421.9		506.2	
Operating expenses	283.1		351.4		421.6	
Net operating revenue	33.1		70.5		84.6	
Interest charges	40.6		51.7		64.6	
Net non-operating revenue (loss)	1.3		1.5		1.6	
Net revenue (deficit)	(6.2)		20.3		21.6	
Exchange losses /a	3.7		3.6		4.0	
Government subsidies against operating losses	25.8		-		-	
Book profit (loss)	15.9		16.7		17.6	
Cash Flow						
Cash generated by KNR	67.8		110.5		130.8	
Less debt service	70.5		86.1		106.2	
Less increase (decrease) in working capital	(4.3)		18.3		14.9	
Net cash available for investment	1.6		6.1		9.7	
Funds needed for investments	156.7	100	288.6	100	248.4	100
Financed From						
Government equity	48.0	31	61.4	21	48.8	20
Foreign borrowing IBRD	32.7	21	42.7	15	4.2	2
Foreign borrowing other	4.8	3	15.2	5	63.2	25
KNR	1.6	1	6.1	2	9.7	4
Local borrowing	69.6	44	163.2	57	122.5	49
	156.7		288.6		248.4	
Balance Sheets						
Current assets	60.1		99.0		122.4	
Less current liabilities	64.0		84.6		93.1	
Net current assets	(3.9)		14.4		29.3	
Fixed assets	1,192.1		1,440.4		1,672.7	
Other assets	55.4		55.4		55.4	
Total assets	1,243.6		1,510.2		1,757.4	
Long-term debt	508.4		698.7		851.0	
Equity equivalent	735.2		811.5		906.4	
Total liabilities	1,243.6		1,510.2		1,757.4	

/a These losses reflect the impact on the long-term debt in foreign currency of the 20% devaluation of the Won, decided by the Government as of January 15, 1980.

Inflation assumptions used for calculating project costs are explained in para. 3.15. Staff numbers were calculated under the asumption that staff productivity expressed in number of traffic units per staff member will improve by 5% in 1980 and 81, and 4% in 1982. Salaries in real terms were assumed to remain steady in 1980, increase by 2% in 1981 and 3% annually thereafter. In addition, salaries were assumed to inflate by 20% in 1980, 17.5% in 1981 and 12% in 1982. In early 1980 the Government increased fuel prices by 59.4% and electricity prices by 37.8%. In addition to these substantial increases, fuel and electricity prices were assumed to increase annually by 3% in real terms and inflate by 17.5% in 1981 and 12% in 1982. Other material prices were inflated by 25% in 1980, 15% in 1981 and 10% in 1982. All these inflation rates were thoroughly discussed and agreed with the Government.

5.17 Due to the unexpectedly steep increase in the cost of energy Korea incurred in early 1980, its economy, and consequently KNR's profitable long distance passenger traffic will not grow as fast as in past years in 1980. The consequent shortage in operating revenue compounded with the adverse effect on KNR's working expenses of the above-mentioned increase in the cost of fuel and electricity explain why KNR's share in the financing of its capital investments will be a low 1% in 1980. As the country's economic growth pace is anticipated to slightly improve in 1981 and to fully recover in 1982, KNR's traffic will progressively recover and tariffs will be raised enough to offset the high level of inflation anticipated during project implementation. Its share in the financing of investments will increse in parallel with this recovery to 2% in 1981 and 4% in 1982. Achievement of these investment financing shares implies that KNR achieve rates of return on its net fixed assets in use of not less than 3.2% in 1980 and 5.5% in each 1981 and 1982. These rates of return were discussed with KNR and the Government who formally agreed on them at negotiations.

5.18 Implementation of the above projections would result in a gradual improvement of KNR's short-term financial situation as reflected by the current ratio which would improve from 1.0 in 1979 to 1.3 in 1982. Further projections show that implementation of the project would result in a substantial increase in KNR's fund generation which is anticipated to more than triple between 1980 and 1986 from W 68 billion in 1980 to about W 220 billion in 1986 with the current ratio reaching 1.7%. Due to the need for substantial local borrowing to finance the local component of the project, the debt to equity ratio would deteriorate from 39/61 at the end of 1979 to 48/52 in 1982. The latter level is close to the ceiling of KNR's prudent borrowing capacity. However, the following analysis demonstrates that KNR's long term financial situation will reasonably improve as a result of implementation of the project.

Forecast Financial Performance (1983-1986)

5.19 The following table summarizes KNR's income accounts (Table 5.1), cash flow (Table 5.5), and balance sheets (Table 5.6) as anticipated during 1983-86:

Table 5.07: SUMMARY INCOME ACCOUNT, CASH FLOW AND BALANCE SHEET 1983-86

	Won Billion			
	1983	1984	1985	1986
Income Account				
Operating revenue	604.9	684.7	772.4	876.1
Working expenses	459.8	520.8	588.9	672.8
Depreciation	39.9	44.9	50.3	56.0
Net Operating Revenue	105.2	119.0	133.2	147.3
Interest charges	75.9	86.1	94.4	100.3
Net non-operating revenue	1.8	1.9	2.1	2.4
Exchange loss	4.2	4.1	3.8	3.6
Net revenue	26.9	30.7	37.1	45.8
Cash Flow				
Cash generated by KNR	157.9	177.8	198.6	219.7
Subsidies	35.2	39.2	64.8	62.3
Borrowing	169.1	197.6	150.5	169.9
Total Sources	362.2	414.6	413.9	451.9
Capital investments	213.9	237.4	237.0	216.6
Debt service	132.7	152.8	179.3	186.3
Total Applications	346.6	390.2	416.3	402.9
Annual Variation in Working Capital	15.6	24.4	(2.4)	49.0
Balance Sheet				
Net working capital	44.9	69.3	66.9	115.9
Net fixed assets in use	1,864.2	2,101.1	2,338.9	2,571.6
Work in progress	24.4	28.5	40.7	53.0
Other assets	55.4	55.4	55.4	55.4
Total Assets	1,988.9	2,254.3	2,501.9	2,795.9
Debt service	967.5	1,102.5	1,171.9	1,259.4
Equity equivalent	1,021.4	1,151.8	1,330.0	1,536.5
Total Liabilities	1,988.9	2,254.3	2,501.9	2,795.9

The following assumptions were used for preparing the table:

Traffic: Achievement of best estimate alternative of traffic forecasts (Tables 2.7 and 2.9)

Tariffs: Raised selectively as necessary to allow KNR to achieve the annual rate of return on average net fixed assets in use of 6% agreed upon at negotiations for 1983-1986. Under present traffic, operating costs and investment assumptions, tariffs would need to be raised over the preceding year by an average of about 8% in 1983, 4% in 1984 and 1985 and 6% in 1986. Increases applied to each type of passenger train and freight commodities would be calculated as to reach by December 31, 1984 the level required under the revised tariff structure described in para. 2.34.

Working Costs: Staff: Staff productivity increased by 4% in 1983 and 1984, and 3% thereafter. Salaries increased by 3% every year for increases in real terms and promotions and by 12% in 1983 and 7% in 1984 through 1986 for inflation.

Fuel: Prices increased in real terms by 3% in 1983 and 1984 and by 2.5% in 1985 and 1986 and for inflation by 12% in 1983 and 7% in 1981 through 1986.

Other Material and Other Expenses: Prices increased for inflation by 10% in 1983 and 9% in 1984 through 1986.

Capital Investments: As per KNR's tentative 1982-86 Investment Plan (Reference C-5,Table 14). The plan is based on KNR's first draft of its 1982-86 Investment Plan prepared for insertion in the Government's Fifth Five Year Plan. It was reviewed by the mission and is a first approximation of minimal investments needed by KNR for carrying forecasted traffic. It amounts to a total of W 1,093.4 billion of which W 239.1 in foreign currency.

Depreciation provision: As per Table 5.4 showing calculations of annual values of depreciable assets and depreciation.

Debt Service (interest and repayment). As per Annex 4, reference C-5, Table 16 under assumptions for financing the 1982-86 Investment Plan shown in reference C-5, Table 14. The foreign component of the plan would be financed entirely from foreign loans, 69% of the local component would be financed from loans provided by the Korean Development Bank, and the rest from KNR's own funds and/or Government subsidies as necessary.

Conclusion

5.20 In addition to providing an adequate rate of return on fixed assets, implementation of the above scheme would result in a substantial improvement

in KNR's both short- and long-term financial position. The current assets to current liabilities ratio would improve from 1.3 by the beginning of 1983 to a comfortable 1.7 by the end of 1986. During the same period, the cash position would increase nearly six-fold from Won 21 billion in 1983 to Won 123 billion in 1986 while accounts receivable and payable would be in line with the requirements explained in para. 5.10. Should this forecast fully materialize, KNR could use excess cash to increase its share in the financing of its capital investments beyond present projections and reduce borrowing from the Korean Development Bank accordingly. The debt to equity ratio, which reflects adequately KNR's long-term financial position would further improve from the comfortable 45/55 level it is planned to reach by December 31, 1986. Implementation of the Seventh Railway Project is consequently fully justified from the financial point of view.

Sensitivity Analysis

5.22 The objective of the sensitivity analysis of financial forecasts is to test KNR's ability to meet its cash needs in case its operating revenues would not attain anticipated levels and/or working expenses, or if the cost of capital investments and the debt service would exceed forecasts used in the main analysis. The sensitivity analysis will be limited to the years 1980 to 1983, during which time the Sixth Railway Project and the proposed project would be completed.

5.23 The main analysis assumes that KNR will achieve the best estimate alternative of the traffic forecasts shown in Tables 2.7 and 2.9. Although these forecasts assume conservative growth rates for both passenger and freight traffic, there is a risk that KNR may fail to meet this target, and particularly if GNP does not grow as anticipated. There is also a risk that tariff increases will not be implemented as anticipated due to social considerations. Another possible hitch is that working costs would exceed appraisal forecasts if the Government and KNR were obliged to grant substantial real term or inflationary salary increases, or if the cost of imported or domestically produced goods or services exceed appraisal estimates. A fourth risk would be an increase in the cost of capital investments beyond present estimates.

5.24 Taking into consideration that simultaneous or full occurence of the above risks is possible, but unlikely, the sensitivity analysis was based on the three following potential cases. (Detailed calculations are given in Annex 4, reference C-5, Table 18)

> Case 1: Simultaneous occurence over 1980-83 of: (a) a decrease in operating revenues of 10% due to a possible reduction in traffic combined with a 50% decrease in tariff increases; (b) a 50% increase in inflation assumptions used for calculating working costs; and (c) a 50% increase in price escalation assumptions for capital investments.

Case 2: Simultaneous occurence over 1980-83 of: (a) a decrease in operating revenues of 5% due to a possible reduction in traffic combined with a 25% decrease in tariff increases; and (b) a 25% increase in inflation assumptions used for calculating working costs.

Case 3. Decrease in operating revenues of 10% over 1980-83 due to a reduction in traffic.

5.25 Table 5.9 shows how full materialization of each of the three sensitivity cases over 1980-83 would affect KNR's annual net operating revenue, net income, variation in working capital and balance sheet. Rates of return on net fixed assets in use would be negative under Cases 1 and 2 and be about one-third of forecasts should Case 3 materialize. The balance sheet and significant ratios as of December 31, 1983 would be as follows:

Table 5.08: SENSITIVITY ANALYSIS - BALANCE SHEETS AS OF DECEMBER 31, 1983 UNDER 3 SENSITIVITY CASES
(won billion)

	Case 1	Case 2	Case 3
Cash	(836.4)	(337.5)	(138.3)
Other current assets	108.8	108.8	108.8
Current liabilities	110.5	110.5	110.5
Net working capital	(838.1)	(339.2)	(140.0)
Net fixed assets	2,003.2	1,888.6	1,888.6
Other assets	55.4	55.4	55.4
Total assets	1,663.0	1,220.5	1,804.0
Long-term debt	967.5	967.5	967.5
Equity equivalent	253.0	637.3	836.5
Total liabilities	1,220.5	1,604.8	1,804.0
Current ratio	0.1	0.25	0.50
Debt/equity ratio	79/21	60/40	54/45

5.26 In the unlikely event that Case 1 would fully materialize, KNR's situation would become untenable as it would be short of about W 850 billion, cumulated over 1980-83, to cover its cash needs, and the debt to equity ratio would reach an alarming 79/21 level which would preclude any additional borrowing. The Government would consequently have to provide KNR with the needed equity to keep its railway in operation. Materialization of Cases 2 or 3 would raise far less problems and KNR should be able to overcome them by additional borrowing. The following table summarizes KNR's balance sheet and significant ratios as of December 31, 1983 under sensitivity Cases 2 and 3, assuming that KNR borrows funds necessary to make up for its shortage of funds and restore its working capital to the minimum level required for continuing its operations. It is further assumed that these funds would be borrowed from the Korean Development Bank at an interest rate of 7.5% with repayment over 20 years, including five years grace. The amounts assumed to be borrowed are W 400 billion under Case 2 and W 170 billion under Case 3.

TABLE 5.09: SENSITIVITY ANALYSIS - BALANCE SHEET AS OF DECEMBER 31, 1983 UNDER SENSITIVITY CASES 2 and 3 AFTER ASSUMED REMEDIAL ACTION

	Case 2	Case 3
Cash	20.6	17.0
Other current assets	100.0	100.0
Current liabilities	105.0	110.0
Net working capital	15.6	7.0
Net fixed assets	1,888.6	1,888.6
Other assets	55.4	55.4
Total assets	1,959.6	1,951.0
Long-term debt	1,367.5	1,137.5
Equity equivalent	592.1	813.5
Total liabilities	1,959.6	1,952.0
Current ratio	1.1	1.1
Debt/equity ratio	62/38	58/42

The table shows that KNR's financial situation would be at the lowest acceptable border-line should sensitivity assumptions 2 or 3 materialize. However, this would be enough to allow KNR to take full advantage of the physical investments and the organizational improvements provided for under the Seventh Railway Project.

6. RECOMMENDATIONS

6.01 During loan negotiations satisfactory assurances were obtained from the Government on the following principal points:

(a) The training of staff to improve the Government's capability in transport planning and coordination (para. 1.17);

(b) a date at which KNR will become a Public Corporation and a time phased plan for implementing short and mid-term measures that will enable this transformation (para. 2.04);

(c) a time phased plan to achieve cost based tariffs (para. 2.34);

(d) the execution of transport sector and urban transport studies (para. 3.19)

(e) a definition of KNR's desirable net working capital and a target date by which KNR should reach it (para. 5.10); and

(f) the rate of return objectives to be achieved by KNR during the project period (para. 5.17).

6.02 With above assurances and agreements, the proposed project is suitable for a Bank loan of US$94 million for a period of 17 years including 4 years of grace to the Government of Korea, for onlending to the KNR.

KOREAN NATIONAL RAILROAD

ASSISTANCE FOR IMPLEMENTING THE RECOMMENDATIONS OF THE STUDY ON THE MANAGEMENT OF THE KOREAN NATIONAL RAILROAD CARRIED OUT BY OVERSEAS BECHTEL INCORPORATED/SAMIL ACCOUNTING CORPORATION

TERMS OF REFERENCE FOR CONSULTANTS

I. Background

1. The Korean National Railroad (KNR) is a semi-autonomous government agency in charge of handling railway services in Korea under the control of the Ministry of Transportation (MOT). Its management structure follows that of the Korean government agencies with the administration having full responsibility of the operations of KNR but only limited authority over KNR's organization, personnel administration and financial matters. KNR's management personnel are government officials and personnel policies are in accordance with the Korean civil service system.

2. KNR's management is generally satisfactory, as reflected by KNR's high operating efficiency. However, some improvement in KNR's organization is desirable to rationalize managerial functions and responsibilities and reinforce its capability for financial, economic and investment planning. Aware of these weaknesses the Government decided to carry out a comprehensive management study under a contract between KNR and Overseas Bechtel Incorporated (Bechtel) in association with the Samil Accounting Corporation dated January 26, 1979. Bechtel's final report was issued on November 12, 1979. Its main conclusion is that KNR should be gradually transformed from its present status to that of public corporation granted with the necessary independence and managerial and financial freedom to fully play its role as an efficient and competitive carrier. This transformation would be prepared by a set of short and mid-term measures aimed at ensuring KNR's smooth transition to a public corporation. To implement certain of the short- and mid-term measures KNR will need the assistance of consultants and/or technical assistants. The objective of the present terms of reference is to define the assistance to be given to KNR for implementing agreed short-term measures. The relevant contract will be financed from a loan granted by the World Bank (the Bank).

II. Objectives of the Short-Term Program

3. The objectives of the short-term program are to:

(a) improve KNR's management decision making process;

(b) improve KNR's operations management effectiveness;

(c) improve KNR's competitive position against other modes of transportation;

(d) increase KNR's profitability;

(e) develop managerial and technical skills within KNR required, in the long term, to manage and operate KNR as a public corporation.

These objectives are intended to provide KNR with the management and organization base from which it can effectively develop the long range management and organization needed to operate successfully as a public corporation.

III. Consultant's Scope of Work

4. To achieve the above objectives the Consultant shall assist KNR in performing the following specific tasks:

A. Planning and Budgeting

(a) Strategic Planning. Developing a first long-range stategic and financial plan and integrating the long-range strategic planning, traffic forecasting and marketing, and financial planning into KNR's current planning function to channel all of its internal resources towards the attainment of its long-term goals and objectives.

(b) Investment Planning. Assisting KNR's recruited economist in developing a methodology for cost benefit analysis of investments.

(c) Performance Budgeting. Developing a methodology and step by step procedures for performance budgeting and assisting KNR in preparing the performance budget.

(d) Planning Legal Action for Transforming KNR into a Public Corporation. In anticipation of KNR becoming, in the long term, a public corporation, preparing a detailed list and timetable for changes in government regulations required for changing KNR status.

B. Management

(a) Management Information. Developing a management information system specifically suitable for the railroad management.

(b) Computer Applications Program. Developing a five-year plan to increase the utilization of computer and specific programs to the operational stage for:

(i) long-range investment planning;

(ii) long-range financial planning;

(iii) traffic forecasting;

(iv) performance budgeting;

(v) management information;

(vi) commercial accounting;

(vii) inventory accounting;

(viii) property and supply control;

(ix) traffic costing;

(x) incremental traffic costing;

(xi) backshop cost accounting; and

(xii) personnel management.

C. Finance and Costing

(a) Commercial Accounting. Complete the implementation of the computerized commercial accounting system. The implementation of this accounting system shall follow applicable Touche Ross recommendations amended as necessary.

(b) Traffic Costing. Improving KNR's traffic costing methodology and computerizing traffic costing process.

(c) Incremental Variable Costing. Developing an incremental variable costing system including a detailed methodology for data collection, refinement, application to the computerized model and model testing.

(d) Tariffs. Developing a new cost based, competitive, and flexible tariff structure based on Bechtel's recommendations (Volume 3 - Financial Study Section 5.0).

E. Training

(a) Management. Developing a comprehensive management training program for both local and overseas training with the emphasis on modern management techniques and computer applications to information gathering and decision making process.

(b) Specialized Staff. Setting up and executing overseas training programs for marketing, personnel management, material management and intermodal operations personnel.

IV. Form of Consultant's Action

5. The Consultants will work together with KNR's staff in order to bring the different components of the Program to the operational stage. This would include (a) the establishment of methodologies; (b) the description of operational procedures and programs; and (c) the design and field test of relevant input and output forms.

6. KNR shall assign the following number of qualified personnel to each task:

	Number of Staff /1
Strategic Planning	-
Traffic Forecasting	-
Investment Planning	-
Performance Budgeting	-
Planning Legal Action for Transforming KNR into a Public Corporation	-
Management Information System	-
Computer Applications Program	-
Commercial Accounting	-
Traffic Costing and Incremental Variable Costing	-
Tariffing	-
Training	-

V. Reports

Progress Reports

7. During the entire implementation program the consultant shall submit to KNR in Korean and English monthly progress reports in __copies summarizing work accomplished during the previous month, pointing out problem areas, and describing plans for the next month's activities.

/1 Depends upon content of consultant's proposal and will be finalized during contract negotiations.

Completion Reports

8. Upon completion of each task described in Section III, the Consultant shall submit a final report in __ copies on this task summarizing the work accomplished and the results obtained. A task will be deemed completed when the operational stage described in Section IV is attained. These final reports shall be prepared in Korean and English and shall be submitted to KNR and the Bank for comments or approval. With the approval of the final report on the last task the work on this implementation program shall be considered as completed.

Consulting Man-Months

9. The Consultant's proposal will list the number of man-months the Consultant plans to assign to each of the tasks listed under para. 4 of these terms of reference and specifying whether the experts proposed will be foreign or Korean.

KOREA

SEVENTH RAILWAY PROJECT

KOREAN NATIONAL RAILROAD (KNR)

Plan for Transforming KNR into a Public Corporation

Timetable for Short-Term Measures

	Reference in Bechtel study: Summary page	Reference in Bechtel study: Studies page	Responsible for implementation	Need for and origin of external assistance: Foreign	Need for and origin of external assistance: Korean	Target date for detailed implementation plan	Target date for implementation (I) or completion (C)
PB Planning & Budgeting							
1. Strengthen long range strategic planning	11	I 68	EPB/MOT/KNR (Planning and coordination)	X		4 months after advisor starts work	C First Plan 12/31/81
2. Strengthen long range investment planning	11	I 54	EPB/MOT/KNR (Planning and coordination)	Recruitment of 1 econ.			C 1 year after recruitment of economist
3. Strengthen long range financial planning	11	IV 63	EPB/MOT/KNR (Planning and coordination)				Depends on completion of 1 and 2
4. Improve traffic forecasting	42	III 49	EPB/MOT/KNR (Planning and coordination)		X		I 6 months after advisor starts work
5. Implement performance budgeting	46	IV 23	KNR (Planning and coordination		X	12/81	I With 1983 budget
6. Prepare detailed list & timetable for changes in Government regulations required for changing KNR status	26	I 12	EPB/MOT/KNR (Administrator)		X		C 12/31/82
MI Management Information							
1. Develop a management information system	20	I 26	KNR (Planning and coordination	X		8 months after advisor starts work	I 06/30/83
FL Finance & Costing							
1. Complete implementing commercial accounting	43	IV 2	KNR (Accounting Bureau)			12/30/81	I 12/30/82
2. Establish a revolving fund system at disposal of the Procurement and Materials Office	56	V 18	KNR (Deputy Administrator)				C 01/01/81
3. Increase backshop inventory to 3 days	55	V 17	KNR (Deputy Administrator)				C 01/01/81
4. Combine the Material Management Office, the Central Supply Office & the Busan Supply Depot under one management	56	V 22	KNR (Deputy Administrator)				C 01/01/81
5. Computerize inventory accounting (financial)		IV 33	KNR (Accounting Bureau/Material Management Office)			Analysis completed 12/31/80	I 12/31/81
6. Computerize material & supply control (physical)		V 16	KNR (Material Management Office)			Analysis completed 06/30/81	I 06/30/83
7. Improve the traffic costing	44	IV 13	KNR (Accounting Bureau)	X		06/30/81	C 12/30/82
8. Develop incremental costing	47	IV 36	KNR (Accounting Bureau)	X		6 months after advisor starts work	C 18 months after advisor starts work
9. Develop backshop cost accounting	45	IV 8	KNR (Accounting Bureau/Rolling Stock/ Backshops)		X	12/30/80	C 01/01/82

	Reference in Bechtel study: Summary page	Reference in Bechtel study: Studies page	Responsible for implementation	Need for and origin of external assistance: Foreign	Need for and origin of external assistance: Korean	Target date for detailed implementation plan	Target date for implementation (I) or completion (C)
CT Commercial & Tariffing							
1. Develop a market research program	11	III 3	KNR (Planning and coordination)				I 01/01/81
2. Implement a strong marketing program	36	III 6	KNR (Transportation Bureau)				I 01/01/81
3. Establish a container operation unit for promoting, organizing & controlling container traffic	-	II 32	KNR (Administrator)			09/30/80	C 01/01/81
4. Design and implement a new cost based & competitive tariff structure	-	IV 72	KNR (Transportation Bureau) (with Government's approval)	X		6 months after advisor starts work	I 18 months after advisor starts work but not later than 01/01/84
CP Computerization							
1. Streamline the present workload of the EDP	21	I 34	KNR (task force including Auditing and Transportation Bureaus/EDP)			09/30/80	I 11/01/81
2. Develop a 5-year computer upgrading programs for: - Long range investment planning - long range financial planning - Traffic forecasting - Performance budgeting - Management information - Commercial accounting - Inventory accounting - Property & supply control - Traffic costing - Incremental traffic costing - Backshop cost accounting - Personnel management	21	I 40	KNR (EDP)	X		03/12/81	C 01/01/82
PM Personnel Management							
1. Reorganize personnel management under a new personnel office	24	I 9	KNR (Administrator)				C 01/01/81
2. Initiate a program to improve the comprehensiveness of personnel statistics	23	I 51	KNR (Personnel Office)		X		C 12/31/81
TG Training							
1. Develop a comprehensive management training program	-	-	KNR (Administrator)	X		09/30/80	
2. Train managerial and supervisory personnel in the application of modern management techniques			KNR (Administrator)	X		09/30/80	I 01/01/81
3. Train senior management personnel in computer technology application for modern management	21	I 41	KNR (Administrator)			09/30/80	I 01/01/81
4. Have personnel responsible for material management trained abroad	56	V 22	KNR (Material Management)	X		09/30/80	I 01/01/81

KOREA

APPRAISAL OF THE SEVENTH RAILWAY PROJECT

Supporting Tables and Charts

TABLES

CHARTS

Chart No.

KOREA

SEVENTH RAILWAY PROJECT

Traffic Statistics 1966 to 1978 Actual and 1981 Forecast
Freight

	Actual										Forecast		
	1966	%	1971	%	AAGR /a 1966-71 % p.a.	1976	%	AAGR /a 1971-76 % p.a.	1977	1978	1981	%	AAGR /a 1976-81 % p.a.
Tons (million)													
Railway	24	41	32	22	5.9	44	18	6.6	47	50	62	16	7.1
Highway	33	56	102	70	25.0	188	76	13.0	216	270	302	78	10.0
Public	(25)		(74)		(24.0)	(94)		(4.9)	(107)	(145)	(151)		(10.0)
Private and Govt.	(8)		(28)		(29.0)	(94)		(27.4)	(109)	(125)	(151)/b		(10.0)
Coastal	2	3	11	8	40.0	14	6	4.9	16	17	25	6	12.3
Total	59	100	145	100	19.7	246	100	11.1	279	337	389	100	9.6
Ton-km (billion)													
Railway	5.9	78	7.8	47	7.6	9.7	45	4.5	10.5	10.9	13.9	40	7.0
Highway	0.8	12	4.0	24	38.0	6.6	30	10.5	7.6	9.7	11.4	33	11.5
Public	(0.6)		(3.3)			(4.4)		(5.9)	(5.1)	(6.8)	(7.6)		(11.5)
Private and Govt.	(0.2)		(0.7)			(2.2)		(25.7)	(2.5)	(2.9)	(3.8)/b		(11.5)
Coastal	0.7	10	4.7	29	46.0	5.5	25	3.2	6.3	6.8	9.4	27	11.4
Total	6.9	100	16.5	100	19.0	21.8	100	5.7	24.4	27.4	34.7	100	9.8

/a AAGR: Average Annual Growth Rate.

/b Estimated using the same growth rate as for public transport since no forecasts are available.

Source: Ministry of Transport, Statistics Yearbook of Transportation 1979 (MOT), FFYP 1977-81, and mission's estimates.

Table 1.1

KOREA

SEVENTH RAILWAY PROJECT

Traffic Statistics 1966 to 1978 Actual and 1981 Forecast
Passengers

	Actual										Forecast		
	1966	%	1971	%	AAGR /a 1966-71 % p.a.	1976	%	AGR /a 1971-76 % p.a.	1977	1978	1981	%	AAGR /a 1976-81 % p.a.
Passengers (million)													
Railway	138	8	128	4		288	5	-	348	429	433	5	-
Intercity	(138)	-	(128)	-	-1.5	(149)	-	3.1	(162)	(176)	(178)	(2)	3.6
SMESRS /b	-	-	-	-		(134)	-	-	(186)	(253)	(265)	(3)	14.6
Highway	1,512	91	3,024	96	-	5,051	95	-	5,931	6,808	7,769	95	-
Intercity buses	(272)	(16)	(333)	(11)	4.1	(652)	(12)	14.4	(803)	(864)	(792)	(10)	4.0
Urban	(1,240)	(75)	(2,691)	(85)	16.8	(4,399)	(83)	10.3	(5,128)	(5,944)	(6,977)	(85)	9.7
Coastal	6	1	6	<1	-	6	<1	-	7	8	7	<1	-
Aviation	-	-	1	<1	-	6	<1	-	1	1	2	<1	-
Total	1,656	100	3,159	100		5,341	100		6,287	7,246	8,221	100	
Passenger-km (billion)													
Railway	8.7	43	8.8	27	0.0	14.7	25	-	17.6	20	20.4	22	-
Intercity	(8.7)	-	(8.8)	-	-	(12.4)	(21)	7.1	(14.6)	(16)	(16.5)	(18)	5.9
SMESRS /b	-	-	-	-	-	(2.3)	(4)	-	(3.1)	(4)	(3.9)	(4)	11.1
Highway	11.5	56	22.9	71	14.8	43.4	74	-	50.7	57	71.6	77	-
Intercity buses	N.A.		(11.6)	(36)	N.A.	(25.0)	(43)	16.6	(29.5)	(32)	(42.4)	(46)	11.1
Urban	N.A.		(11.3)	(35)	N.A.	(18.4)	(31)	10.2	(21.2)	(25)	(29.2)	(31)	9.7
Coastal	0.2	1	0.3	1	-	0.2	<1	-	0.3	0.3	0.4	<1	-
Aviation	0.1	-	0.3	1		0.3	<1	-	0.4	0.5	0.6	<1	-
Total	20.5	100	32.3	100		58.6	100		69.0	78	93.0		

/a AAGR: Average Annual Growth Rate.

/b SMESRS includes Traffic on KNR Seoul Suburban lines as well as Seoul City Subway.

Source: Ministry of Transport, Statistics Yearbook of Transportion 1979 (MOT), FFYP 1977-81, and mission's estimates.

Table 1.3

KOREA

SEVENTH RAILWAY PROJECT

Total Transport Investment - Third Plan (1972-76) and Fourth Plan (1977-81)
(Billion won in 1975 prices)

Modes		1972-76 Actual		1977-81 Planned	
Roads	(Public)	(237)	833	(458)	1,226
	(Private)	(596)		(768)	
Railways			318		402
Ports and marine	(Public)	(130)		(251)	
	(Private)	(412)	522	(745)	996
Air transport			122		59
Seoul subway			57		101
Other			5		-
Total transport investment			1,857		2,784
Total capital expenditure			11,996		19,028
Transportation as % of total			15.7%		14.6%

Source: EPB.

Table 1.4

KOREA

SEVENTH RAILWAY PROJECT

Transport Sector Investments
Planned, Actual and Budgeted

Fourth Five Year Plan 1977-81

	Plan total 1977-81	1977 Actual	1978 Budget	1979 Budget	Total 77-79	
	---------- Won billion (in 1975 prices) ----------					in % of plan
Roads /a						
Central Government	291	64.6	47.3	43.6	155.5	53
Local Government /b	100	89.9	110.3	n.a.	n.a.	2 years 200%
Railways	402	53.8	62.9	100.3	217.0	54
Ports						
Ordinary	140	24.1	26.5	25.8	76.4	55
Industrial	111	26.2	23.8	20.8	70.8	64
Aviation	59	10.0	16.8	15.2	42.0	71
Total	1,103	268.6	287.6	n.a.	n.a.	n.a.
Total without local Government roads	1,003	178.7 Budget was 222.5	177.3	205.7	561.7	56

/a The difference between the total road investment given here (W 391 billion) and that in Table 1.3 (W 458 billion) is made up by the costs of maintenance and studies which are included in the plan document, but not above.

/b The large increase in local government investments in roads are mostly the fact of the two special cities Seoul and Busan which invested W 54 billion in 1977 and W 84 billion in 1978 (in 1975 prices). In 1978 this was almost twice as much as total central government investment in roads.

KOREA

SEVENTH RAILWAY PROJECT

KNR Track and Infrastructure - Summary by End 1979
(Standard gauge lines)

Line	Route length (km)	Maximum gradient (%)	Minimum curve radius (m)	Total curve length (km)	Maximum axle load (tons)	Maximum speed (km/hr)	Permanent speed restrictions (km)	Sleeper type Wood (%)	Sleeper type Concrete (%)	Remarks
Gyeong Bu	445	1.00	400	330	24.5	110	443	64	36	Double track
Jung Ang	383	2.30	300	162	24.5	80	328	74	26	Double track 11 km
Gyeong In	27	1.00	300	22	24.5	80	27	69	31	Double track 39 km
Jang Hang	144	1.53	300	45	22.0	70	64	100	0	
Chung Bug	122	1.67	300	56	24.5	70	88	100	0	
Gyeong Bug	110	2.50	250	36	24.5	70	65	95	5	
Dae Gu	35	1.25	300	12	24.5	80	22	56	44	
Gyeong Eui	46	1.00	300	12	24.5	90	25	96	4	Double track 9 km
Gyeong Weon	89	1.33	300	24	24.5	80	56	84	16	Double track 21 km
Gyeong Chun	87	2.45	250	41	24.5	70	71	100	0	
Gyeong Jeon	315	2.50	250	129	22.0	70	251	97	3	
Ho Nam	260	1.33	300	91	24.5	90	152	66	34	Double track 82 km
Jeon Ra	198	2.50	250	87	24.5	80	142	62	38	
Donghae Nambu	146	1.40	300	55	24.5	80	85	77	21	
Tae Baeg	106	3.03	300	51	24.5	70	95	75	5	
Yeong Dong	199	3.00	250	120	24.5	70	196	94	6	
Other lines	400			176			274	96	4	
Total	3,111			1,449			2,384	79	21	

Source: KNR

Table 2.1

KOREA

SEVENTH RAILWAY PROJECT

Rails in KNR Standard Gauge Main Line Tracks at End of 1978
(Quantities in track km)

Line	Rail weight (kg/m) and age (years)															Grand total	Rail length			
	50 kg/m					37 kg/m					Less than 37 kg/m						Long welded	20-25 m	Less than 20 m	Grand total
	<10	11-20	21-30	>30	Total	<10	11-20	21-30	>30	Total	<10	11-20	21-30	>30	Total					
Gyeong Bu	790	162	59	-	1,011	-	-	-	-	-	-	-	-	-	-	1,011	132	862	17	1,011
Jung Ang	395	25	-	-	420	-	-	-	45	45	-	-	-	-	-	465	16	394	55	465
Gyeong In	75	7	-	-	82	-	-	-	1	1	-	-	-	-	-	83	-	78	5	83
Jang Hang	147	-	8	-	155	-	-	-	-	-	-	-	-	-	-	155	2	153	-	155
Chung Bug	131	19	-	-	150	-	-	-	-	-	-	-	-	-	-	150	5	145	-	150
Gyeong Bug	5	86	-	-	91	-	35	2	-	37	-	-	-	-	-	128	5	86	37	128
Dae Gu	40	-	-	-	40	-	-	-	-	-	-	-	-	-	-	40	-	40	-	40
Gyeong Eui	14	19	30	-	63	-	-	-	-	-	-	-	-	-	-	63	5	58	-	63
Gyeong Weon	41	18	1	-	60	-	-	13	57	70	-	-	-	-	-	130	6	54	70	130
Gyeong Chun	6	4	42	19	71	-	-	-	22	22	-	-	-	-	-	93	-	71	22	93
Gyeong Jeon	114	55	-	-	169	-	179	-	-	179	-	-	-	-	-	348	9	160	179	348
Ho Nam	326	20	25	1	372	-	-	-	6	6	-	-	-	-	-	378	6	366	6	378
Jeon Ra	181	20	-	-	201	-	10	3	-	13	-	-	-	-	-	214	19	182	13	214
Donghae Nambu	135	11	11	-	157	-	9	-	-	9	-	-	-	-	-	166	13	144	9	166
Tae Baeg	79	38	-	-	117	-	-	-	-	-	-	-	-	-	-	117	-	117	-	117
Yeong Dong	143	36	14	-	193	-	30	-	-	30	-	-	-	-	-	223	-	193	30	223
Other lines	37	21	35	74	167	21	28	48	91	188	-	-	27	101	128	483	26	141	316	483
Total	2,659	541	225	94	3,519	21	291	66	222	600	-	-	27	101	128	4,247	244	3,244	759	4,247

Source: KNR.

Table 2.2

KOREA

SEVENTH RAILWAY PROJECT

Inventory of Motive Power and Rolling Stock
(As of December 31, 1979)

	Total			Out of service		Age				Condition		
	In fleet Number	In service Number	%	Under repair Number	Awaiting repair Number	<10 years Number	11-20 years Number	21-30 years Number	>30 years Number	Good Number	Fair Number	Poor Number
1. Steam Locomotives	40	11	27.5	2	27	-	-	21	19	-	-	40
2. Diesel Locomotives												
Shunter, series 2000 (800 HP)	13	12	92.3	1	-	-	-	13	-	-	13	-
Shunter, series 2100 (1,000 HP)	28	27	96.4	1	-	-	28	-	-	28	-	-
Shunters, Total	41	39	95.1	2	-	-	28	13	-	28	13	-
Mainline locomotives, series 3000 (875 HP)	51	50	98.0	1	-	-	45	6	-	51	-	-
Mainline locomotives, series 3100 (875 HP)	7	5	71.4	2	-	-	7	-	-	-	5	2
Mainline locomotives, series 3200 (950 HP)	41	41	100.0	-	-	-	41	-	-	41	-	-
Mainline locomotives, series 4000 (1,300 HP)	15	14	93.3	1	-	-	15	-	-	15	-	-
Mainline locomotives, series 4100 (1,300 HP)	10	9	90.0	1	-	-	10	-	-	10	-	-
Mainline locomotives, series 4200 (1,300 HP)	22	22	100.0	-	-	-	22	-	-	22	-	-
Mainline locomotives, series 5000 (1,750 HP)	29	28	96.6	1	-	-	-	29	-	-	29	-
Mainline locomotives, series 6000 (1,800 HP)	14	13	92.9	1	-	-	14	-	-	2	12	-
Mainline locomotives, series 6100 (1,800 HP)	6	6	100.0	-	-	-	6	-	-	6	-	-
Mainline locomotives, series 6200 (1,800 HP)	17	16	94.1	1	-	-	17	-	-	1	16	-
Mainline locomotives, series 6300 (2,000 HP)	23	23	100.0	-	-	-	23	-	-	11	12	-
Mainline locomotives, series 7000 (3,000 HP)	10	8	80.0	2	-	10	-	-	-	10	-	-
Mainline locomotives, series 7100 (3,000 HP)	40	38	95.0	2	-	40	-	-	-	40	-	-
Mainline locomotives, series 7500 (3,000 HP)	80	75	93.8	3	2	80	-	-	-	80	-	-
Mainline Locomotives, Total	365	348	95.3	15	2	130	200	35	-	318	45	2
Diesel Locomotives, Total	406	387	95.3	17	2	130	228	48	-	346	58	2
3. Electric Locomotives												
a. Mainline locomotives	90	81	90.0	9	-	90	-	-	-	90	-	-
b. Shunters	-	-	-	-	-	-	-	-	-	-	-	-
4. Diesel Railcars (Powered units)	120	99	82.5	15	6	6	114	-	-	12	108	-
5. Electric Railcars (Powered units)	252	220	87.3	32	-	252	-	-	-	252	-	-
6. Heating Cars	163	148	90.8	8	7	65	81	17	-	125	-	38
7. Passenger Cars												
a. Air-conditioned coaches	165	164	99.4	-	1	156	-	-	-	165	-	-
b. Other coaches	1,292	1,246	96.4	39	7	490	749	46	7	851	295	146
c. Sleeping cars	35	33	94.3	2	-	19	12	-	4	31	-	4
d. Restaurant cars	27	27	100.0	-	-	21	6	-	-	27	-	-
e. Baggage cars	165	160	96.9	5	-	6	120	9	30	126	9	30
f. Railcar trailers	60	58	96.6	2	-	-	60	-	-	60	-	-
g. Other	71	70	98.6	1	-	43	5	12	11	48	12	11
Total	1,815	1,758	96.8	49	8	735	961	67	52	1,308	316	191
8. Freight Cars (KNR)												
a. Box cars	5,150	4,939	95.9	160	51	2,458	1,134	1,516	42	3,560	661	929
b. Gondolas	7,069	6,645	94.0	318	106	4,444	2,225	381	19	5,931	976	162
c. Tank cars	1,441	1,362	94.5	50	29	338	678	220	205	682	343	416
d. Others	1,721	1,555	90.4	57	109	828	113	458	322	901	166	654
Total	15,381	14,501	94.3	585	295	8,068	4,150	2,575	1,588	11,074	2,146	2,161
9. Privately Owned Freight Cars												
a. Box cars	125	118	94.4	6	1	125	-	-	-	125	-	-
b. Gondolas	224	217	96.9	6	1	224	-	-	-	224	-	-
c. Tank cars	1,276	1,233	96.6	34	9	486	567	223	-	1,276	-	-
d. Others	8	7	87.5	-	1	6	2	-	-	8	-	-
Total	1,633	1,575	96.4	46	12	841	569	223	-	1,633	-	-

Source: KNR.

Table 2.4

KOREA

SEVENTH RAILWAY PROJECT

Carrying Capacity of Rolling Stock
(As of December 31, 1979)

	Number	Total carrying capacity /a
1. Passenger Cars		
(a) Air-conditioned sitting cars	165	9,748
(b) Other sitting cars (including railcars	1,724	147,347
(c) Sleeping cars	35	956
Total	1,924	158,051
2. Freight Cars		
(a) Box cars - up to 30 tons	17	350
40 tons	2,710	108,400
50 tons	2,548	127,400
Subtotal	5,275	236,150
(b) Gondolas - up to 30 tons	22	500
40 tons	2,129	85,160
50 tons	5,142	257,100
Subtotal	7,293	342,760
(c) Tank cars - up to 30 tons	387	10,568
31-40 tons	1,133	43,963
over 40 tons	1,197	59,767
Subtotal	2,717	114,298
(d) Other cars	1,729	65,201
Total	17,014	758,409

/a For passenger cars - seats, for freight cars - tons.

Source: KNR.

Table 2.5

KOREA

SEVENTH RAILWAY PROJECT

KNR Freight Traffic: 1966-78 Actual and 1980-86 Forecast
(Million tons)

Years	Major Commodities							Others					
	Coal	Cement	Ore	Oil	Fertilizer	Grain	Subtotal	General cargo	Private car return	Container	Military	KNR	Total
1. Actual													
1966	10.5	1.7	1.1	0.9	1.2	1.2	16.6	4.4			2.1	0.9	24.0
Second FYP													
1967	11.2	2.2	1.4	1.4	1.2	1.3	18.7	5.6			2.3	0.8	27.4
1968	9.7	3.2	1.7	1.7	1.5	1.6	19.4	5.9			2.8	1.0	29.1
1969	10.4	4.4	1.7	2.1	1.2	1.4	21.2	5.6			2.7	1.2	30.7
1970	12.1	4.9	1.8	2.4	1.1	1.3	23.6	5.0			2.1	1.0	31.7
1971	12.2	5.8	1.6	2.5	1.1	1.4	24.6	4.6			1.9	0.9	32.0
Third FYP													
1972	11.3	6.0	1.5	2.2	1.3	1.6	23.9	4.6		-	2.4	0.7	31.6
1973	13.6	7.5	2.3	2.7	1.5	1.6	29.2	5.5		0.2	1.7	1.0	37.6
1974	15.1	7.8	2.9	2.7	1.9	1.3	31.7	5.1		0.2	1.3	1.1	39.4
1975	16.7	9.0	3.0	3.1	2.2	1.0	35.0	3.5	1.5	0.2	1.4	1.1	42.7
1976	16.1	10.2	3.4	3.1	1.8	1.3	35.9	3.2	1.6	0.3	1.5	1.3	43.8
Fourth FYP													
1977	17.5	10.3	3.2	3.5	2.1	1.2	37.8	4.6	1.9	0.5	1.5	1.3	47.6
1978	17.9	10.9	3.1	3.8	2.2	1.2	39.1	4.8	2.0	0.6	1.5	1.6	49.6
1979	18.0	11.2	3.4	4.3	2.1	1.1	40.1	4.7	2.0	0.6	1.5	2.0	50.9
1980													
1981													
2. Forecast (best estimate)													
1980	18.3	11.8	3.6	4.6	2.3	1.1	41.7	4.9	2.1	0.7	1.5	2.1	53.0
1981	19.0	12.5	3.8	4.8	2.5	1.2	43.8	5.4	2.2	0.9	1.5	2.1	55.9
Fifth FYP													
1982	19.5	13.5	4.0	5.0	2.6	1.3	45.9	5.9	2.3	1.1	1.5	1.7	58.4
1983	19.8	14.5	4.2	5.2	2.7	1.4	47.8	6.1	2.4	1.5	1.5	1.7	61.0
1984	20.0	15.0	4.4	5.4	2.8	1.4	49.0	6.4	2.4	1.7	1.5	1.7	62.7
1985	20.2	15.5	4.7	5.7	2.9	1.5	50.5	6.7	2.5	1.9	1.5	1.8	64.9
1986	20.5	16.0	5.0	6.0	3.0	1.5	52.0	7.0	2.5	2.2	1.5	1.8	67.0
3. Forecast (high)													
1980	19.0	12.7	3.6	4.7	2.5	1.3	43.8	5.3	2.1	0.9	1.5	2.1	55.7
1981	19.5	13.7	3.8	5.1	2.6	1.4	46.1	5.9	2.4	1.1	1.5	2.1	59.1
Fifth FYP													
1982	19.5	14.5	4.0	5.5	2.6	1.5	47.6	6.2	2.4	1.3	1.5	1.7	60.7
1983	19.8	15.5	4.2	6.0	2.7	1.6	49.8	6.5	2.5	1.6	1.5	1.7	63.6
1984	20.3	16.5	4.4	6.3	2.8	1.6	51.9	6.8	2.5	1.9	1.5	1.7	66.3
1985	20.6	17.5	4.7	6.6	2.9	1.7	54.0	7.1	2.6	2.2	1.5	1.8	69.2
1986	20.9	18.0	5.0	7.0	3.0	1.7	55.6	7.5	2.6	2.5	1.5	1.8	71.5
4. Forecast (low)													
1980	18.0	11.5	3.6	4.6	2.2	1.1	41.0	4.9	2.1	0.7	1.5	2.1	52.3
1981	18.2	12.0	3.8	4.8	2.2	1.2	42.2	5.1	2.2	0.9	1.5	2.1	54.0
Fifth FYP													
1982	18.4	12.5	4.0	5.0	2.3	1.3	43.5	5.3	2.3	1.1	1.5	1.7	55.4
1983	18.6	13.0	4.2	5.2	2.3	1.4	44.7	5.6	2.4	1.5	1.5	1.7	57.4
1984	18.8	13.5	4.3	5.4	2.4	1.4	45.8	5.9	2.4	1.7	1.5	1.7	59.0
1985	18.9	14.0	4.4	5.7	2.4	1.5	46.9	6.2	2.5	1.9	1.5	1.8	60.8
1986	19.0	15.0	4.5	6.0	2.5	1.5	48.5	6.5	2.5	2.2	1.5	1.8	63.0

Note: Since 1977 General Cargo includes slag and gypsum previously included under Ore. Slag and gypsum accounted for 0.8 million tons in 1977 and 1.1 million tons in 1979. Return of private cars, mostly oil tankers, are now shown separately from General Cargo. KNR charges half the tare weight at Class III freight rate for this traffic.

Source: KNR/Bank.

KOREA

SEVENTH RAILWAY PROJECT

KNR Freight Traffic: 1966-78 Actual and 1980-86 Forecast
(Average distance in km)

Years	Major Commodities						Others					Total
	Coal	Cement	Ore	Oil	Fertilizer	Grain	General cargo	Private car return	Container	Military	KNR	
1. ACTUAL												
1966	103	280	244	351	155	265	270			200	104	
Second FYP												
1967	206	257	239	302	168	260	263			197	104	
1968	219	264	216	346	208	254	267			196	97	
1969	321	207	236	297	275	274	286			205	104	
1970	230	205	252	267	284	309	305			209	148	
1971	236	211	272	290	313	288	279			236	113	
Third FYP												
1972	232	188	231	261	267	251	255		incl.	240	110	
1973	235	179	247	239	280	238	270		in	264	113	
1974	226	171	259	240	278	257	262		general	275	116	
1975	221	160	253	223	268	256	279	185	cargo	275	118	
1976	228	177	261	224	287	270	276	170		266	125	
Fourth FYP												
1977	225	173	245	222	267	241	279	169	445	260	128	
1978	221	170	242	229	262	277	277	183	440	260	139	
1979	213	187	239	217	254	305	264	190	438	269	127	
1980												
1981												
4. FORECAST (best estimate)												
1980	215	180	240	220	255	275	275	180	440	260	135	
1981	210	170	240	225	255	275	275	180	440	260	135	
Fifth FYP												
1982-86	210	150	240	225	255	275	275	180	430 to 400	260	135	

Source: KNR.

Table 2.6

Table 2.7

KOREA

SEVENTH RAILWAY PROJECT

KNR Freight Traffic: 1966-78 Actual and 1980-86 Forecast
(Million ton-km)

Years	Major commodities							Others					Total
	Coal	Cement	Ore	Oil	Ferti-lizer	Grain	Subtotal	General cargo	Private car return	Con-tainer	Mili-tary	KNR	
1. ACTUAL													
1966	2,185	476	269	316	186	318	3,750	1,186			420	94	5,450
Second FYP													
1967	2,306	565	335	423	202	338	4,169	1,472			454	83	6,178
1968	2,125	845	368	589	312	406	4,645	1,577			548	97	6,867
1969	2,397	911	402	624	330	384	5,048	1,602			553	125	7,328
1970	2,785	1,003	453	641	312	402	5,595	1,526			439	148	7,709
1971	2,881	1,222	435	724	344	403	6,009	1,281			449	102	7,841
Third FYP													
1972	2,620	1,125	347	574	347	402	5,415	1,174			575	77	7,241
1973	3,201	1,344	568	645	420	381	6,559	1,486			433	113	8,591
1974	3,408	1,336	751	649	525	334	7,003	1,517			357	128	9,005
1975	3,677	1,437	760	625	590	256	7,345	960	304	92	385	207	9,293
1976	3,654	1,804	889	638	516	352	7,894	858	280	110	399	163	9,728
Fourth FYP													
1977	3,933	1,781	785	732	561	289	8,081	1,290	308	232	383	215	10,509
1978	3,963	1,846	741	868	595	338	8,351	1,338	358	275	376	228	10,926
1979	3,829	2,085	817	931	525	351	8,538	1,240	382	254	411	256	11,081
1980													
1981													
2. FORECAST (best estimate)													
1980	3,935	2,124	864	1,012	587	303	8,825	1,347	378	308	390	284	11,532
1981	3,990	2,125	912	1,080	638	330	9,075	1,485	396	396	390	284	12,026
Fifth FYP													
1982	4,095	2,025	960	1,125	663	358	9,226	1,623	414	473	390	230	12,356
1983	4,158	2,175	1,008	1,170	689	385	9,585	1,678	432	630	390	230	12,945
1984	4,200	2,250	1,056	1,215	714	385	9,820	1,760	432	697	390	230	13,329
1985	4,242	2,325	1,128	1,283	740	413	10,131	1,843	450	760	390	243	13,817
1986	4,305	2,400	1,200	1,350	765	413	10,433	1,925	450	880	390	243	14,321
3. FORECAST (high)													
1980	4,085	2,159	864	1,034	638	358	9,138	1,458	378	396	390	284	12,044
1981	4,095	2,192	912	1,148	663	385	9,395	1,623	432	484	390	284	12,608
Fifth FYP													
1982	4,095	2,175	960	1,238	663	413	9,554	1,705	432	559	390	230	12,860
1983	4,158	2,325	1,008	1,350	689	440	9,970	1,789	450	672	390	230	13,501
1984	4,263	2,475	1,056	1,418	714	440	10,366	1,870	450	779	390	230	14,085
1985	4,326	2,625	1,128	1,485	740	468	10,772	1,953	468	880	390	243	14,706
1986	4,389	2,700	1,200	1,575	765	468	11,097	2,063	468	1,000	390	243	15,261
3. FORECAST (low)													
1980	3,780	1,725	864	1,035	561	303	8,268	1,347	378	308	390	284	10,975
1981	3,822	1,800	912	1,080	561	330	8,505	1,403	396	396	390	284	11,374
Fifth FYP													
1982	3,864	1,875	960	1,125	587	358	8,769	1,458	414	473	390	230	11,734
1983	3,906	1,950	1,008	1,170	587	385	9,006	1,540	432	630	390	230	12,228
1984	3,948	2,025	1,032	1,215	612	385	9,217	1,623	432	697	390	230	12,589
1985	3,969	2,100	1,056	1,283	612	413	9,433	1,705	450	760	390	243	12,981
1986	3,990	2,250	1,080	1,350	638	413	9,721	1,788	450	880	390	243	13,472

Note: Until 1975, return of private cars and containers were included in general cargo.

Source: KNR/Bank.

Table 2.8

KOREA

SEVENTH RAILWAY PROJECT

KNR Intercity Passenger Traffic: 1966-78 Actual and 1980-86 Forecast

	No. of passengers (millions)				Passenger-km (millions)				Average distance (km)			
	Commuter	Long distance /a	Military	Total	Commuter	Long distance /a	Military	Total	Commuter	Long distance /a	Military	Total
1. ACTUAL												
1966	38.4	98.0	1.9	138.3	830	7,288	546	8,664	21.6	74.4	285.0	62.7
Second FYP												
1967	41.6	108.4	1.9	151.9	883	8,150	543	9,576	21.2	75.2	288.9	63.6
1968	38.7	110.6	1.6	150.9	828	9,280	482	10,590	21.3	83.9	301.2	70.1
1969	37.9	114.8	2.0	154.7	799	9,680	598	11,077	20.0	84.0	304.0	71.0
1970	38.2	91.4	1.7	131.3	854	8,425	539	9,818	22.4	92.2	299.4	74.8
1971	41.4	85.2	1.6	128.2	940	7,300	510	8,750	22.7	85.7	320.0	68.3
Third FYP												
1972	26.3	109.2	1.6	137.2	629	8,914	519	10,062	23.9	81.6	324.4	73.3
1973	22.5	118.9	1.6	143.0	552	9,681	487	10,720	24.5	81.4	304.4	75.0
1974	20.6	117.6	1.6	139.8	481	9,581	471	10,533	23.4	81.4	294.4	75.3
1975	15.1	122.0	1.4	138.6	326	10,626	434	11,386	21.6	87.1	310.0	82.1
1976	17.2	130.1	1.3	148.6	367	11,678	395	12,440	21.3	89.8	303.8	78.6
Fourth FYP												
1977	17.4	143.5	1.3	162.2	380	13,782	401	14,563	21.8	96.0	308.5	89.8
1978	18.2	155.7	1.7	175.6	402	15,670	516	16,588	22.1	100.6	306.0	94.5
1979	19.6	162.1	1.3	183.0	434	16,253	399	17,086	22.2	100.3	318.9	93.4
1980												
1981												
2. FORECAST (best estimate)												
1980	20.6	172	1.4	194	453	18,222	434	19,109	22	106	310	99
1981	21.6	182	1.4	205	475	20,113	434	21,022	22	111	310	103
Fifth FYP												
1982	22.6	194	1.4	218	497	22,290	434	23,221	22	115	310	107
1983	23.6	205	1.4	230	519	24,135	434	25,088	22	118	310	109
1984	24.6	217	1.4	243	541	25,855	434	26,830	22	119	310	110
1985	25.6	228	1.4	255	563	27,375	434	28,372	22	120	310	111
1986	26.6	240	1.4	268	585	28,975	434	29,994	22	121	310	112
3. FORECAST (high)												
1980	20.6	175	1.4	197	453	18,967	434	19,854	22	108	310	101
1981	21.6	188	1.4	211	475	21,495	434	22,404	22	114	310	106
Fifth FYP												
1982	22.6	202	1.4	226	497	23,852	434	24,783	22	118	310	110
1983	23.6	212	1.4	241	519	26,132	434	27,085	22	121	310	112
1984	24.6	230	1.4	256	541	28,225	434	29,200	22	123	310	114
1985	25.6	245	1.4	272	563	30,326	434	31,323	22	124	310	115
1986	26.6	260	1.4	288	585	32,460	434	33,479	22	125	310	116
4. FORECAST (low)												
1980	20.6	171	1.4	193	453	17,762	434	18,649	22	104	310	97
1981	21.6	180	1.4	203	475	19,423	434	20,332	22	108	310	100
Fifth FYP												
1982	22.6	189	1.4	213	497	20,905	434	21,836	22	111	310	103
1983	23.6	198	1.4	223	519	22,335	434	23,288	22	113	310	104
1984	24.6	208	1.4	234	541	23,670	434	24,645	22	114	310	105
1985	25.6	218	1.4	245	563	25,025	434	26,022	22	115	310	106
1986	26.6	228	1.4	256	585	26,365	434	27,384	22	116	310	107

/a See detail forecast by type of service, Table 2.9.

Source: KNR/Bank.

Table 2.9

KOREA

SEVENTH RAILWAY PROJECT

KNR Long Distance Intercity Passenger Traffic by Type of Service
1971-78 Actual and 1980-86 Forecast

Years	Number of Passengers (millions)							Passenger-km (millions)							Average Distance (km)						
		Ltd. Exp.							Ltd. Exp.							Ltd. Exp.					
	Spec. Exp.	A.C.	Non A.C.	Sub-total	Ord. Exp.	Ord.	Total	Spec. Exp.	A.C.	Non A.C.	Sub-total	Ord. Exp.	Ord.	Total	Spec. Exp.	A.C.	Non A.C.	Ord. Exp.	Ord.	Total
1. ACTUAL																				
1971	0.3		3.8		-	81.7	85.8	117		1,071		-	6,112	7,300	393		285	-	75	85
Third FYP																				
1972	0.4		5.9		-	102.9	109.2	147		1,653		-	7,115	8,915	383		283	-	69	82
1973	0.5		7.6		-	110.8	118.9	183		2,105		-	7,393	9,681	374		277	-	67	81
1974	0.6		8.8		4.4	103.8	117.6	234		2,224		940	6,183	9,581	367		254	213	60	81
1975	0.8		11.5		4.7	104.8	121.8	298		2,862		1,004	6,463	10,627	359		250	203	62	87
1976	1.3		15.0		5.4	108.3	130.1	465		3,673		1,025	6,516	11,679	352		245	190	60	90
Fourth FYP																				
1977	1.6	0.4	27.4	27.8	8.5	105.6	143.5	550	122	6,291	6,413	1,357	5,463	13,783	344	282	229	160	52	96
1978	1.9	1.6	34.4	36.0	9.4	108.4	155.7	645	461	7,852	8,313	1,287	5,425	15,670	333	282	228	137	50	101
1979	2.4	2.0	36.1	38.1	8.7	112.9	162.1	772	530	8,252	8,780	1,207	5,492	16,253	327	268	228	138	49	100
1980																				
1981																				
2. FORECAST (best estimate)																				
1980	3.0	6	40	46	9.0	114	172	975	1,560	9,000	10,560	1,215	5,472	18,222	325	260	225	135	48	106
1981	3.5	10	45	55	9.5	114	182	1,120	2,500	9,900	12,400	1,235	5,358	20,113	320	250	220	130	48	111
Fifth FYP																				
1982	4.0	16	49	65	10.0	115	194	1,260	3,840	10,535	14,375	1,250	5,405	22,290	315	240	215	125	47	115
1983	4.5	22	53	75	10.5	115	205	1,395	5,060	11,130	16,190	1,260	5,290	24,135	310	230	210	120	46	118
1984	5.0	28	57	85	11.0	116	217	1,525	6,160	11,685	17,845	1,265	5,220	25,855	305	220	205	115	45	119
1985	5.5	36	59	95	11.5	116	228	1,650	7,560	11,800	19,360	1,265	5,100	27,375	300	210	200	110	44	120
1986	6.0	44	61	105	12.0	117	240	1,770	9,020	11,895	20,915	1,260	5,030	28,975	295	205	195	105	43	121
3. FORECAST (high)																				
1980	3.0	8	41	49	9.0	114	175	975	2,080	9,225	11,305	1,215	5,472	18,967	325	260	225	135	48	108
1981	3.5	14	46	60	9.5	115	188	1,120	3,500	10,120	13,620	1,235	5,520	21,495	320	250	220	130	48	114
Fifth FYP																				
1982	4	20	51	71	11	116	202	1,260	4,800	10,965	15,765	1,375	5,452	23,852	315	240	215	125	47	118
1983	5	27	55	82	12	117	216	1,550	6,210	11,550	17,760	1,440	5,382	26,132	310	230	210	120	46	121
1984	6	35	58	93	13	118	230	1,830	7,700	11,890	19,590	1,495	5,310	28,225	305	220	205	115	45	123
1985	7	45	60	105	14	119	245	2,100	9,450	12,000	21,450	1,540	5,236	30,326	300	210	200	110	44	124
1986	8	55	62	117	15	120	260	2,360	11,275	12,090	23,365	1,575	5,160	32,460	295	205	195	105	43	125
4. FORECAST (low)																				
1980	3.0	5	40	45	9.0	114	171	975	1,300	8,800	10,300	1,215	5,472	17,762	325	260	220	135	48	104
1981	3.5	9	44	53	9.5	114	180	1,120	2,250	9,460	11,710	1,235	5,358	19,423	320	250	215	130	48	108
Fifth FYP																				
1982	4.0	13	47	60	10.0	115	189	1,260	3,120	9,870	12,990	1,250	5,405	20,905	315	240	210	125	47	111
1983	4.5	18	50	68	10.5	115	198	1,395	4,140	10,250	14,390	1,260	5,290	22,335	310	230	205	120	46	113
1984	5.0	23	53	76	11.0	116	208	1,525	5,060	10,600	15,660	1,265	5,220	23,670	305	220	200	115	45	114
1985	5.5	29	56	85	11.5	116	218	1,650	6,090	10,920	17,010	1,265	5,100	25,025	300	210	195	110	44	115
1986	6.0	34	59	93	12.0	117	228	1,770	6,800	11,505	18,305	1,260	5,030	26,365	295	200	195	105	43	116

Source: KNR/Bank.

Table 2.10

KOREA

SEVENTH RAILWAY PROJECT

KNR Seoul Urban (SMESRS) Passenger Traffic
1971-78 Actual and 1980-86 Forecast

Years	Number of Passengers (millions) Commuter	Noncommuter	Total	Passenger-km (millions)	Average distance (km)
1. ACTUAL					
1974	5.9	22.7	28.6	545	19.1
1975	17.1	65.3	82.4	1,540	18.7
1976	19.1	80.5	100.2	1,865	18.6
Fourth FYP					
1977	25.9	113.5	139.4	2,536	18.2
1978	38.3	157.1	195.4	3,466	17.7
1979	50.6	192.6	243.2	4,467	18.4
1980					
1981					
4. FORECAST (KNR's estimate)					
1980	71.9	267.4	339.3	5,881	17.3
1981	91.1	329.0	420.1	7,152	17.0
Fifth FYP					
1982	111.8	388.2	500.0	8,441	16.9
1983	132.6	446.4	579.0	9,646	16.7
1984	151.9	500.0	651.9	10,718	16.4
1985	167.8	545.0	712.8	11,617	16.3
1986	181.2	583.0	764.2	12,284	16.1

Source: KNR.

KOREA

SEVENTH RAILWAY PROJECT

Selected Operating Statistics

	1971	1972	1973	1974	1975	1976	1977	1978	1979	Index 1979 (1971 = 100)
A. System (at end of year)										
1. Route length (km)	3,199	3,121	3,133	3,143	3,144	3,144	3,142	3,153	3,158	99
(a) Standard gauge (1.435 m)	3,074	3,069	3,086	3,096	3,096	3,097	3.095	3,106	3,111	101
(b) Narrow gauge (1.067 m)	125	52	47	47	47	47	47	47	47	38
(c) Double track	537	537	537	553	561	567	602	607	607	419
(d) Electrified	-	-	155	340	402	402	419	419	419	-
2. Number of stations	589	573	573	565	566	566	571	590	583	99
3. Average distance between stations (km)	5.43	5.45	5.47	5.56	5.56	5.56	5.50	5.44	5.42	100
B. Staff (at end of year)										
1. Number of employees	43,638	44,344	41,202	39,911	39,560	39,293	40,017	40,377	40,186	92
(a) Permanent	36,067	35,914	33,748	33.594	33,748	33,481	33,266	3,685	32,492	90
(b) Temporary	7,571	8,430	7,454	6,317	5,807	5,812	6,751	6,692	6,694	88
C. Rolling Stock /a										
1. Steam locomotives /b										
(a) In fleet, number	80	80	60	51	41	25	21	17	14	18
(b) Available, number	56	56	43	38	32	12	13	12	10	18
(c) Available, %	70.0	70.0	71.7	74.5	78.0	48.0	61.9	70.6	71.4	102
2. Diesel locomotive, main line										
(a) In fleet, number	296	295	295	295	300	330	329	330	348	118
(b) Available, number	245	259	259	265	260	285	286	291	312	127
(c) Available, %	82.8	87.8	87.8	89.5	86.7	86.4	86.9	88.2	89.7	108
3. Diesel locomotive, shunters										
(a) In fleet, number	38	41	41	41	41	41	57/c	56	56	147
(b) Available, number	34	39	39	39	39	36	48	49	49	144
(c) Available, %	89.5	95.1	95.1	95.1	95.1	87.8	84.2	87.5	87.5	98
4. Electric locomotive, main line										
(a) In fleet, number	-	-	37	49	66	65	81	89	90	-
(b) Available, number	-	-	31	42	56	55	69	80	81	-
(c) Available, %	-	-	83.8	85.7	84.8	84.6	85.2	89.9	90.0	-
5. Diesel railcars, powered units										
(a) In fleet, number	156	155	152	121	119	123	120	119	118	75
(b) Available, number	109	101	79	71	86	98	90	94	97	87
(c) Available, %	69.9	65.2	48.2	58.7	72.3	79.7	75.0	79.0	82.2	118
6. Electric railcars, powered units										
(a) In fleet, number	-	-	37	49	126	126	135	193	235	-
(b) Available, number	-	-	31	42	110	114	118	173	209	-
(c) Available, %	-	-	-	92.3	87.3	90.5	87.4	89.6	88.9	-
7. Passenger cars, including railcar trailers										
(a) In fleet, total number	1,662	1,604	1,581	1,571	1,712	1,760	1,803	1,765	1,794	108
- airconditioned coaches	55	55	55	55	65	71	70	101	141	256
- other coaches	1,272	1,219	1,206	1,180	1,293	1,335	1,378	1,295	1,323	104
- sleeping cars	16	16	16	19	27	29	31	36	35	219
- restaurant cars	26	26	26	26	26	24	21	21	23	88
- baggage cars	110	109	109	116	122	117	120	127	153	139
- railcar trailers	142	145	145	146	146	144	141	141	60	42
- other	34	34	30	29	33	40	42	44	59	173
(b) Available, number	1,412	1,357	1,387	1,388	1,515	1,559	1,612	1,610	1,635	116
(c) Available, %	85.0	84.6	82.4	88.4	88.5	88.7	89.4	91.2	91.1	107
8. Freight cars										
(a) In fleet, total number (incl. privately owned cars)	14,575	15,975	16,491	15,887	15,794	15,964	16,134	15,710	16,205	111
- box cars	4,850	5,391	5,343	5,128	4,993	5,096	5,009	4,790	4,973	103
- gondolas	5,663	6,073	6,546	6,264	6,380	6,548	6,662	6,579	6,713	119
- flat cars	1,252	1,585	1,755	1,656	1,572	1,416	1,133	1,166	1,148	92
- tank cars	2,137	2,289	2,264	2,234	2,266	2,379	2,489	2,621	2,687	126
- others	673	637	683	605	583	525	841	554	684	102
(b) Available, number	13,038	13,845	14,543	14,251	14,358	14,259	14,769	14,627	15,233	117
(c) Available, %	89.5	86.6	88.2	89.7	90.9	89.3	91.5	93.1	94.0	105
(d) In fleet, privately owned	1,367	1,389	1,385	1,407	1,422	1,445	1,518	1,542	1,607	117

	1971	1972	1973	1974	1975	1976	1977	1978	1979	Index 1979 (1971 = 100)
D. Traffic										
1. Passenger traffic										
(a) Number of passengers total (million)	128.1	137.1	143.0	168.5	221.0	248.7	301.6	371.0	423.7	331
- Seoul suburban (SMESRS)	-	-	-	28.7	82.4	100.1	139.4	195.4	240.7	-
- Other	128.1	137.1	143.0	139.8	138.6	148.5	162.2	175.6	183.0	143
(b) Passenger-km (million)	8,750	10,062	10,720	11,077	12,926	14,305	17,099	20,054	21,386	244
- Seoul suburban (SMESRS)	-	-	-	545	1,540	1,865	2,536	3,466	4,300	-
- Other	8,750	10,062	10,720	10,532	11,386	12,440	14,563	16,588	17,086	195
(c) Average journey, total	68.3	73.4	75.0	65.7	56.5	57.5	56.7	54.1	50.5	74
- Seoul suburban (SMESRS)	-	-	-	19.0	18.7	18.6	18.2	17.7	17.9	-
- Other	68.3	73.4	75.0	75.3	82.2	83.7	89.8	94.5	93.4	137
2. Freight traffic										
(a) Net tons (000)	31,955	31,541	37,762	39,708	42,758	43,630	47,631	49,654	50,879	159
(b) Net ton-km (million)	7,841	7,241	8,591	9,005	9,293	9,728	10,509	10,926	11,081	141
(c) Average freight haul	245	230	228	227	217	223	221	220	218	89
3. Traffic units (million)	16,591	17,303	19,311	20,082	22,219	24,033	27,608	30,980	32,467	196
4. Traffic density										
(a) Passenger-km per route km (000)	2,735	3,224	3,422	3,524	4,111	4,550	5,442	6,360	6,772	248
(b) Freight net ton-km per route km (000)	2,451	2,320	2,742	2,865	2,956	3,094	3,345	3,465	3,509	143
(c) Traffic units per route km (000)	5,186	5,544	6,166	6,389	7,067	7,644	8,787	9,826	10,281	198
E. Operations										
1. Train-km (000)	42,226	44,528	46,017	46,790	51,022	55,393	58,217	61,376	64,103	152
(a) According to types of train:										
(i) Passenger (incl. railcars)	24,455	27,602	27,794	27,669	31,123	34,807	36,905	39,157	41,553	170
(ii) Freight	17,771	16,926	18,223	19,121	19,899	20,586	21,312	22,219	22,550	127
(b) According to types of traction:										
(i) Steam locomotive	976	257	240	105	69	45	32	5	-	-
(ii) Diesel locomotive	35,426	38,808	39,665	38,015	37,876	41,326	42,780	43,800	45,562	129
(iii) Electric locomotive	-	-	2,145	4,449	5,336	5,475	6,719	7,443	7,386	-
(iv) Diesel railcar	5,824	5,463	3,967	3,204	4,380	4,662	4,283	4,066	4,055	70
(v) Electric railcar	-	-	-	1,017	3,361	3,885	4,403	6,062	7,099	-
2. Engine-km, excluding shunting	52,887	53,812	53,702	58,457	76,923	84,781	90,335	102,102	110,005	208
(a) Steam locomotives	1,291	365	290	148	-	-	-	-	-	-
(b) Diesel locomotives	39,310	41,356	41,812	40,051	39,870	43,324	45,040	45,984	48,789	124
(c) Electric locomotives	-	-	2,227	4,625	6,242	6,509	8,306	9,388	9,442	-
(d) Diesel railcars	12,286	12,091	9,373	8,221	10,647	11,641	10,563	10,373	10,667	87
(e) Electric railcars	-	-	-	5,412	20,164	23,307	26,426	36,357	42,107	-
3. Rolling stock-km (million)										
(a) Passenger cars, total	178	204	208	213	241	265	287	315	340	191
(b) Freight cars, total	332	322	372	374	385	402	430	444	452	136
- loaded	208	190	214	216	219	226	245	251	252	121
- empty /d	124	132	158	158	166	176	185	193	200	161
4. Loaded freight cars forwarded (000)	847	782	883	888	966	972	1,052	1,089	1,102	130
5. Average freight car turnaround time (days)	5.6	6.5	6.0	5.9	5.4	5.4	5.1	4.9	5.0	89
6. Average freight car turnaround distance (m)	392	412	421	421	399	414	409	408	410	105

	1971	1972	1973	1974	1975	1976	1977	1978	1979	Index 1979 (1971 = 100)
F. Performance Indicators										
1. Passenger traffic										
(a) Average number of passengers per passenger train	358	364	386	400	415	411	463	512	515	144
(b) Average number of passengers per passenger car	49.2	49.3	51.5	52.0	53.6	54.0	59.6	63.7	62.9	128
2. Freight traffic										
(a) Average number of freight cars per freight train	18.7	19.0	20.4	19.6	19.3	19.5	20.2	20.0	20.0	107
- loaded	11.7	10.6	11.9	11.3	11.0	11.0	11.5	11.3	11.2	96
- empty	7.0	8.4	8.5	8.3	8.3	8.5	8.7	8.7	8.8	126
(b) Average freight train load (net tons)	441	428	471	471	467	472	493	492	491	111
(c) Average load per loaded freight car (net tons)	37.7	40.3	42.8	44.8	44.6	44.9	45.3	45.6	46.2	123
3. Staff										
(a) Traffic units per employee (000)	379	393	451	495	561	612	690	767	808	213
(b) Employees per route-km	13.7	14.1	13.7	12.98	12.6	12.5	12.7	12.8	12.7	93
4. Rolling stock										
(a) Availability (%):										
(i) Steam locomotives	70.0	70.0	71.7	74.5	78.0	48.0	61.9	70.6	71.4	102
(ii) Diesel locomotives, main line	82.8	87.8	87.8	89.5	86.7	86.4	86.9	88.2	89.7	108
(iii) Electric locomotives	-	-	83.8	85.7	84.8	84.6	85.2	89.9	90.0	-
(iv) Diesel railcars, powered units	69.9	65.2	48.0	58.7	72.3	79.7	75.0	79.0	82.2	118
(v) Electric railcars, powered units	-	-	-	92.3	87.3	90.5	87.4	89.6	88.9	-
(vi) Passenger cars	85.0	84.6	87.4	88.4	88.5	88.7	89.4	91.2	91.1	107
(vii) Freight cars	89.5	86.6	88.2	89.7	90.9	89.3	91.5	93.1	94.0	105
(b) Yearly distance covered per available unit: (km 000)										
(i) Diesel main line	160	160	161	152	153	152	157	158	156	98
(ii) Electric main line locomotives	-	-	72	110	111	118	120	117	117	-
(iii) Diesel railcars	113	120	119	116	123	119	117	108	110	97
(iv) Electric railcars	-	-	-	75	183	204	224	210	201	-
(v) Passenger cars	126	150	150	153	159	170	178	196	210	167
(vi) Freight cars	25.4	23.2	25.6	26.2	26.8	28.2	29.1	30.4	29.7	117
(c) Passenger-km per available passenger car, including rail cars (000)	5,772	6,901	7,312	7,235	7,528	8,077	9,034	10,684	11,018	193
(d) Net ton-km per available freight car (000)	601	523	591	632	647	682	712	747	727	121

/a Number in fleet is average of number at beginning and end of year. Available number is average number during year.

/b Excluding locomotives kept in reserve.

/c 16 line locomotives transferred to shunters.

/d Including cabooses.

Source: KNR.

KOREA

SEVENTH RAILWAY PROJECT

KOREAN NATIONAL RAILROAD (KNR)

Traffic Costing 1979 - Full Year

	T O T A L S										
	Traffic PK/TK million	Revenue	Operating Costs				Net operating revenue	Interest charges		Total cost	Net profit/loss
			Total	Variable %	Variable Amount	Fixed		%	Amount		
		-(Won billion)--			-------- (Won billion) --------				---- (Won billion) ----		
PASSENGERS											
Special express	772	11.2	4.5	86.5	3.9	0.6	6.7	3.5	0.7	5.2	6.0
Limited express - A/C /a	530	5.7	4.6	67.4	3.1	1.5	1.1	4.6	0.9	5.5	0.2
- Non A/C	8,252	55.2	27.3	68.8	18.8	8.5	27.9	38.0	7.4	34.7	20.5
Ordinary express	1,253	5.1	5.9	54.1	3.2	2.7	(0.8)	5.6	1.1	7.0	(1.9)
Ordinary trains	5,867	18.6	37.0	54.1	20.0	17.0	(18.4)	23.0	4.5	41.5	(22.9)
Commuters	434	0.9	4.3	45.3	1.9	2.4	(3.4)	1.8	0.4	4.7	(3.8)
Military	399	2.2	1.4	95.3	1.3	0.1	0.8	1.8	0.4	1.8	0.4
Seoul urban (SMESR)	4,300	20.6	17.8	51.3	9.1	8.7	2.8	19.3	3.8	21.6	(1.0)
Baggage	498	6.1	7.9	22.1	1.7	6.2	(1.8)	2.4	0.5	8.4	(2.3)
Total	22,305	125.6	110.7	56.9	63.0	47.7	14.9		19.7	130.4	(4.8)
FREIGHT											
Grain	351	2.4	3.2	64.5	2.1	1.1	(0.8)	3.2	0.3	3.5	(1.1)
Fertilizer	525	3.6	5.5	63.7	3.5	2.0	(1.9)	5.3	0.5	6.0	(2.4)
Cement	2,085	16.3	16.2	74.6	12.1	4.1	0.1	17.5	1.7	17.9	(1.6)
Coal	3,829	24.3	32.6	71.8	23.4	9.2	(8.3)	35.9	3.3	35.9	(11.6)
Ore	1,231	8.0	6.3	71.0	4.5	1.8	1.7	6.9	0.7	7.0	1.0
Oil	817	5.7	7.8	69.2	5.4	2.4	(2.1)	8.2	0.8	8.6	(2.9)
Other	1,662	12.9	17.3	69.9	12.1	5.2	(4.4)	17.6	1.7	19.0	(6.1)
Military	472	2.4	3.5	63.9	2.2	1.3	(1.1)	3.4	0.3	3.8	(1.4)
KNR	255	-	2.1	63.2	1.3	0.8	(2.1)	2.0	0.2	2.3	(2.3)
Total	11,228	75.6	94.5	70.5	66.6	27.9	(18.9)		9.5	104.0	(28.4)
Miscellaneous	-	7.2	-	-	-	-	7.2		-	-	7.2
Grand Total	35,533	208.4	205.2	-	129.6	75.6	3.2		29.2	234.4	(26.0)

	P E R T R A F F I C U N I T S									
	Revenue	Operating Costs			Net Operating Revenue	Cost Coverage		Interest charges	Total cost	Profit (loss) Amount	Cost coverage
		Total	Variable	Fixed		Variable	Fixed				
	---------- (Won) ----------					(%)	(%)	----------	(Won)	--------	(%)
PASSENGERS											
Special express	14.51	5.83	5.04	0.79	8.68	100	100	0.83	6.66	7.85	217
Limited express - A/C	10.75	8.68	5.85	2.83	2.07	100	100	0.81	9.49	1.26	113
- Non A/C	6.69	3.31	2.28	1.03	3.38	100	100	0.82	4.13	2.56	162
Ordinary express	4.07	4.71	2.55	2.16	(0.64)	100	70	0.80	5.51	(1.44)	74
Ordinary trains	3.17	6.31	3.41	2.90	(3.14)	93	-	0.82	7.13	(3.96)	44
Commuters	2.07	9.91	4.49	5.42	(7.84)	46	-	0.93	10.84	(8.77)	19
Military	5.51	3.51	3.35	0.16	2.00	100	100	0.91	4.42	1.09	125
Seoul urban (SMEIR)	4.79	4.14	2.12	2.02	0.65	100	100	0.83	4.97	(0.18)	96
Baggage	12.25	15.86	3.51	12.35	(3.61)	100	71	0.85	16.71	4.46	73
Average	5.63	4.96	2.82	2.14	0.67	100	100	0.83	5.79	(0.16)	97
FREIGHT											
Grain	6.83	9.12	5.88	3.24	(2.29)	100	29	0.82	9.94	(3.11)	69
Fertilizer	6.85	10.47	6.67	3.80	(3.62)	100	5	0.82	11.20	(4.44)	61
Cement	7.82	7.77	5.80	1.97	0.05	100	100	0.84	8.61	(0.79)	96
Coal	6.34	8.51	6.11	2.40	(2.17)	100	10	0.82	9.33	(2.99)	68
Ore	6.50	5.12	3.64	1.48	1.38	100	100	0.88	6.00	0.50	108
Oil	6.97	9.55	6.61	2.94	(2.58)	100	12	0.85	10.40	(3.43)	67
Other	7.76	10.41	7.28	3.13	(2.65)	100	15	0.84	11.25	(3.49)	69
Military	5.08	7.41	4.74	2.67	(2.33)	100	13	0.76	8.17	(3.09)	62
KNR	-	8.20	5.18	3.02	(8.20)	-	-	0.88	9.08	(9.08)	-
Average	6.73	8.42	5.93	2.49	(1.09)	100	32	0.83	9.25	(2.52)	73

/a A/C = air-conditioned.

KOREA

SEVENTH RAILWAY PROJECT

KNR Investment Plan, 1977-81

	1977 (actual)			1978 (actual)			1979 (estimated)			1980 (planned)			1981 (planned)			1982 (planned)			Total 1977-82					
	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total
	(Won million)																					(US$'000)		
1. New Line Construction																								
1.1 Industrial sidings	992	-	992	3,826	-	3,826	1,750	-	1,750	4,264	-	4,264	7,330	-	7,330	-	-	-	18,162	-	18,162	33,532	-	33,532
Subtotal Category 1	992	-	992	3,826	-	3,826	1,750	-	1,750	4,264	-	4,264	7,330	-	7,330	-	-	-	18,162	-	18,162	33,532	-	33,532
2. Electrification																								
2.1 Industrial sidings	719	-	719	140	30	170	351	-	351	-	-	-	-	-	-	-	-	-	1,210	30	1,240	2,495	62	2,557
Subtotal Category 2	719	-	719	140	30	170	351	-	351	-	-	-	-	-	-	-	-	-	1,210	30	1,240	2,495	62	2,557
3. Increase in Station and Line Capacity																								
3.1 Double Tracking																								
3.1.1 Gyeong Bu line (32.3 km)	988	-	988	1,980	548	2,528	8,100	154	8,254	15,400	-	15,400	14,395	995	15,390	-	-	-	40,863	1,697	42,560	74,192	3,162	77,354
3.1.2 Chung Bug line (113 km)	1,734	404	2,138	6,645	-	6,645	47,613	134	47,747	9,727	1,683	11,410	-	-	-	-	-	-	65,719	2,221	67,940	132,218	4,011	136,229
3.1.3 Yong San line (9.6 km)	-	-	-	-	-	-	645	-	645	-	-	-	8,312	-	8,312	-	-	-	8,957	-	8,957	15,661	-	15,661
3.1.4 Gyeong Weon line (13.1 km)	-	-	-	-	-	-	435	-	435	858	-	858	10,929	-	10,929	-	-	-	12,222	-	12,222	21,219	-	21,219
3.1.5 Ho Nam line (26.9 km)	4,932	-	4,932	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,932	-	4,932	10,169	-	10,169
Subtotal Category 3.1	7,654	404	8,058	8,625	548	9,173	56,793	288	57,081	25,985	1,683	27,668	33,636	995	34,637	-	-	-	132,693	3,918	136,611	253,459	7,173	260,632
3.2 Bypass lines (3 places)	315	-	315	1,422	-	1,422	2,600	134	2,756	879	-	879	4,316	220	4,536	-	-	-	9,532	374	9,906	17,899	697	18,596
3.3 Additional crossing loops (24 places)	585	-	585	1,155	-	1,155	2,812	-	2,812	1,760	70	1,830	1,760	70	1,830	-	-	-	8,072	140	8,212	15,455	241	15,696
3.4 Marshalling yard extensions (2 places)	1,114	-	1,114	1,370	-	1,370	1,015	-	1,015	260	-	260	3,970	-	3,970	-	-	-	7,729	-	7,729	14,507	-	14,507
3.5 Station yard extensions (11 places)	-	-	-	606	-	606	595	-	595	1,323	-	1,323	920	-	920	-	-	-	3,444	-	3,444	6,343	-	6,343
3.6 Freight handling facilities	302	-	302	-	-	-	3,500	-	3,500	3,463	-	3,463	13,465	-	13,465	3,940	-	3,940	24,670	-	24,670	43,818	-	43,818
3.7 Lengthening of crossing loops (15 places)	427	-	427	317	-	317	1,032	-	1,032	890	35	925	1,190	45	1,235	-	-	-	3,856	80	3,936	7,248	138	7,386
3.8 Station installations	2,593	-	2,593	4,827	-	4,827	7,382	-	7,382	2,855	-	2,855	4,060	-	4,060	-	-	-	21,717	-	21,717	42,442	-	42,442
3.9 Signaling	2,001	1,162	3,163	1,499	-	1,499	2,108	112	2,220	1,700	-	1,700	7,255	-	7,255	15,225	15,985	31,210	29,788	17,259	47,047	53,253	30,188	83,441
3.10 Busan area improvements	73	-	73	664	-	664	-	-	-	-	-	-	860	90	950	-	-	-	1,597	90	1,687	3,003	155	3,158
Subtotal Category 3	15,064	1,566	16,630	20,485	548	21,033	77,837	554	78,391	39,115	1,788	40,903	71,432	1,420	72,852	19,165	15,985	35,150	243,098	21,861	264,959	457,427	38,592	496,019
4. Way and Structures																								
4.1 Rail renewal, 50 kg rails (640 km)	1,246	243	1,489	1,555	2,748	4,303	880	4,536	5,416	450	1,600	2,050	800	2,840	3,640	-	-	-	4,931	11,967	16,898	9,745	23,175	32,920
4.2 Rail renewal, 60 kg rails (30 km)	-	-	-	-	-	-	-	-	-	-	-	-	-	885	885	210	-	210	210	885	1,095	362	1,526	1,888
4.3 Track renewal, 50 kg rails (140 km)	655	-	655	326	473	799	455	192	647	950	490	1,440	950	740	1,690	475	-	475	3,811	1,895	5,706	7,056	3,492	10,548
4.4 Track renewal, 60 kg rails (60 km)	-	-	-	-	-	-	-	-	-	-	-	-	-	1,770	1,770	2,850	-	2,850	2,850	1,770	4,620	4,914	3,052	7,966
4.5 Concrete sleepers (220,000)	670	-	670	818	-	818	886	-	886	385	-	385	975	-	975	-	-	-	3,734	-	3,734	7,240	-	7,240
4.6 Points and crossings (530)	227	-	227	285	428	713	344	230	574	460	-	460	460	-	460	-	-	-	1,776	658	2,434	3,351	1,356	4,707
4.7 Ballast (95,000 cu m)	-	-	-	-	-	-	150	-	150	140	-	140	340	-	340	-	-	-	630	-	630	1,137	-	1,137
4.8 Bridge strengthening (689 spans)	1,519	-	1,519	605	-	605	848	-	848	810	-	810	810	-	810	-	-	-	4,592	-	4,592	8,921	-	8,921
4.9 Tunnel strengthening	130	-	130	221	-	221	550	-	550	575	-	575	575	-	575	-	-	-	2,051	-	2,051	3,841	-	3,841
4.10 Level crossings	1,117	-	1,117	1,408	-	1,408	2,060	-	2,060	2,150	-	2,150	2,150	-	2,150	-	-	-	8,885	-	8,885	16,868	-	16,868
4.11 Permanent way workshop	355	539	894	-	-	-	235	-	235	430	1,282	1,712	2,255	300	2,555	-	-	-	3,275	2,121	5,396	5,846	3,838	9,684
4.12 Permanent way equipment	-	-	-	367	497	864	22	539	561	-	-	-	40	2,020	2,060	-	-	-	429	3,056	3,485	871	5,619	6,490
4.13 Miscellaneous	903	-	903	1,732	-	1,732	1,622	-	1,622	1,125	-	1,125	1,585	-	1,585	-	-	-	6,967	-	6,967	13,449	-	13,449
Subtotal Category 4	6,822	782	7,604	7,317	4,146	11,463	8,052	5,497	13,549	7,475	3,372	10,847	10,940	8,555	19,495	3,535	-	3,535	44,141	22,352	66,493	83,601	42,056	125,659
5. Motive Power and Rolling Stock																								
5.1 New diesel locomotives, main line (40)	-	-	-	287	7,178	7,465	144	-	144	867	4,168	5,035	1,050	4,180	5,230	-	-	-	2,348	15,526	17,874	4,194	29,193	33,387
5.2 New electric locomotives, main line (14)	926	8,342	9,268	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	926	8,342	9,268	1,909	17,200	19,109
5.3 New diesel railcars (12)	-	-	-	-	-	-	-	-	-	2,335	-	2,335	-	-	-	-	-	-	2,335	-	2,335	4,026	-	4,026
5.4 New electric railcars for SMESRS (254)	9,310	-	9,310	10,295	-	10,295	10,875	-	10,875	17,920	-	17,920	28,670	-	28,670	-	-	-	77,070	-	77,070	143,173	-	143,173
5.5 New electric railcars, intercity (16)	-	-	-	-	-	-	-	-	-	4,425	-	4,425	-	-	-	-	-	-	4,425	-	4,425	7,629	-	7,629
5.6 New breakdown cranes (5)	-	-	-	-	-	-	155	1,065	1,220	-	-	-	40	905	945	-	-	-	195	1,970	2,165	389	3,756	4,145
5.7 Motive power remodeling/repair	1,487	3,507	4,994	3,257	9,204	12,461	829	4,978	5,807	1,360	4,400	5,760	1,360	-	1,360	-	-	-	8,293	22,089	30,382	16,181	44,058	60,239
5.8 New passenger cars (534)	3,898	1,401	5,299	-	-	-	566	14,737	15,303	3,036	14,482	17,518	5,330	26,510	31,840	-	-	-	12,830	57,130	69,960	23,628	103,950	127,578
5.9 Passenger car remodeling/repair	300	-	300	474	-	474	455	-	455	95	-	95	340	-	340	-	-	-	1,664	-	1,664	3,284	-	3,284
5.10 New freight cars (2,810)	49	5,793	5,842	78	2,656	2,734	2,325	13,148	15,473	159	10,074	10,233	-	1,910	1,910	-	-	-	2,611	33,580	36,192	5,330	65,192	70,522
5.11 Freight car remodeling/repair	525	-	525	561	-	561	609	-	609	235	-	235	350	-	350	-	-	-	2,280	-	2,280	4,503	-	4,503
Subtotal Category 5	16,495	19,043	35,538	14,952	19,038	33,990	15,958	33,928	49,886	30,432	33,124	63,556	37,140	33,505	70,645	-	-	-	114,977	138,638	253,615	214,246	263,349	477,595
6. Motive Power and Rolling Stock Repair Facilities																								
6.1 New Daejeon car shops	606	115	721	1,959	968	2,927	4,127	-	4,127	5,411	2,040	7,451	24,409	-	24,409	-	-	-	36,512	3,123	39,635	65,212	5,750	70,962
6.2 Improvement of existing backshops	79	-	79	62	-	62	329	-	329	360	-	360	1,740	470	2,210	-	-	-	2,570	470	3,040	4,590	810	5,400
6.3 Improvement of existing sheds	185	70	255	1,249	-	1,249	1,665	-	1,665	230	-	230	1,870	1,400	3,275	-	-	-	5,199	1,470	6,669	10,011	2,558	12,569
Subtotal Category 6	870	185	1,055	3,270	968	4,238	6,121	-	6,121	6,001	2,040	8,041	28,019	1,870	29,889	-	-	-	44,281	5,063	49,344	79,813	9,118	88,931
7. Telecommunications, Power Facilities, Buildings and Others																								
7.1 Telecommunications	575	-	575	114	-	114	694	-	694	440	-	440	500	-	500	-	-	-	2,323	-	2,323	4,471	-	4,471
7.2 Power facilities	106	-	106	103	-	103	660	-	660	265	-	265	265	-	265	-	-	-	1,399	-	1,399	2,706	-	2,706
7.3 Buildings	1,467	-	1,467	59	-	59	4,000	-	4,000	9,016	-	9,016	1,330	-	1,330	-	-	-	15,872	-	15,872	29,232	-	29,232
7.4 Housing and hospitals	691	-	691	625	-	625	1,442	-	1,442	2,135	-	2,135	1,530	2,320	3,850	-	-	-	6,423	2,320	8,743	12,006	4,000	16,006
7.5 Training and technical assistance	30	132	162	33	49	82	109	928	1,037	45	1,160	1,205	75	1,685	1,760	-	440	440	292	4,394	4,686	562	7,950	8,512
7.6 Miscellaneous	291	-	291	569	-	569	926	-	926	560	-	560	560	-	560	-	-	-	2,906	-	2,906	5,613	-	5,613
Subtotal Category 7	3,160	132	3,292	1,503	49	1,552	7,831	928	8,759	12,461	1,160	13,621	4,260	4,005	8,265	-	440	440	29,215	6,714	35,929	54,590	11,950	66,540
Total Categories 1 - 7	44,122	21,708	65,830	51,493	24,779	76,272	117,900	40,907	158,807	99,748	41,484	141,232	158,121	49,355	208,476	22,700	16,425	39,125	495,084	194,658	889,742	925,704	365,129	1,290,833
8. Physical contingencies for investments starting in 1980/81 (5% in 1980, 10% in 1981-82, except for items 4.1 - 4.4 and Category 5)	-	-	-	-	-	-	-	-	-	3,390	319	3,709	12,024	961	12,985	1,917	1,643	3,560	17,331	2,922	20,253	29,881	5,038	34,919
9. Price contingencies for investments starting in 1980/81 (for local currency items 25% in 1980, 15% in 1981 and 10% in 1982; for foreign currency items 10.5% in 1980, 9% in 1981 and 8% in 1982)	-	-	-	-	-	-	-	-	-	12,892	2,193	15,085	58,812	7,786	66,598	12,540	4,563	17,103	84,242	14,544	98,786	145,246	25,076	170,322
GRAND TOTAL	44,122	21,708	65,830	51,493	24,779	76,272	117,900	40,907	158,807	116,030	43,996	160,026	229,957	58,102	288,059	37,157	22,631	59,788	596,657	212,124	808,781	1,100,831	395,243	1,496,074

KOREA

SEVENTH RAILWAY PROJECT

The Project (KNR Investments Starting in 1980/81)

		1980			1981			1982			Total 1980-82					
		Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total
		(Won million)												(US$'000)		
A.	KNR Investments Starting in 1980/81															
1.	New Line Construction															
1.1	Industrial siding, Posco (6.5 km)	-	-	-	980	-	980	-	-	-	980	-	980	1,690	-	1,690
1.2	Industrial siding, Gwangyang (24 km)	-	-	-	6,350	-	6,350	-	-	-	6,350	-	6,350	10,948	-	10,948
	Subtotal Category 1	-	-	-	7,330	-	7,330	-	-	-	7,330	-	7,330	12,638	-	12,638
2.	Increase in Station and Line Capacity															
2.1	Double tracking, Seoul-Suweon (32.3 km)	15,400	-	15,400	14,395	995	15,390	-	-	-	29,795	995	30,790	51,370	1,716	53,086
2.2	Bypass line, Jecheon (3.5 km)	-	-	-	945	220	1,165	-	-	-	945	220	1,165	1,629	379	2,008
2.3	Additional crossing loops (8 places on 7 lines)	1,760	70	1,830	1,760	70	1,830	-	-	-	3,520	140	3,660	6,069	241	6,310
2.4	Station yard extensions (4 places on 4 lines)	920	-	920	920	-	920	-	-	-	1,840	-	1,840	3,172	-	3,172
2.5	Freight terminal, West Seoul	-	-	-	2,530	-	2,530	3,940	-	3,940	6,470	-	6,470	11,155	-	11,155
2.6	Lengthening of crossing loops (7 places on 4 lines)	890	35	925	1,190	45	1,235	-	-	-	2,080	80	2,160	3,586	138	3,724
2.7	Station Installations															
2.7.1	Seoul station	345	-	345	1,150	-	1,150	-	-	-	1,495	-	1,495	2,578	-	2,578
2.7.2	Station buildings (10 places)	1,065	-	1,065	705	-	705	-	-	-	1,770	-	1,770	3,052	-	3,036
2.7.3	Underground passages (3 places)	-	-	-	520	-	520	-	-	-	520	-	520	897	-	897
2.7.4	Freight sheds (10 places)	270	-	270	270	-	270	-	-	-	540	-	540	931	-	931
2.7.5	Automatic ticket vending machines (120)	130	-	130	640	-	640	-	-	-	770	-	770	1,327	-	1,327
2.7.6	Other facilities	1,045	-	1,045	775	-	775	-	-	-	1,820	-	1,820	3,138	-	3,138
	Subtotal Category 2.7	2,855	-	2,855	4,060	-	4,060	-	-	-	6,915	-	6,915	11,923	-	11,923
2.8	Signaling															
2.8.1	Automatic train stop (48 places)	130	-	130	145	-	145	-	-	-	275	-	275	474	-	474
2.8.2	CTC, Yeongju-Gyeongju (163.5 km)	-	-	-	2,300	-	2,300	9,670	9,675	19,345	11,970	9,675	21,645	20,638	16,681	37,319
2.8.3	CTC, Jecheon-Baegsan (106.7 km)	-	-	-	2,300	-	2,300	5,555	6,310	11,865	7,855	6,310	14,165	13,543	10,879	24,422
2.8.4	Tokenless block signaling (21 places)	-	-	-	1,205	-	1,205	-	-	-	1,205	-	1,205	2,078	-	2,078
2.8.5	Interlocking (8 places)	860	-	860	515	-	515	-	-	-	1,375	-	1,375	2,371	-	2,371
2.8.6	Warning devices at level crossings (200 places)	490	-	490	740	-	740	-	-	-	1,230	-	1,230	2,121	-	2,121
2.8.7	External signaling	-	-	-	50	-	50	-	-	-	50	-	50	86	-	86
	Subtotal Category 2.8	1,480	-	1,480	7,255	-	7,255	15,225	15,985	31,210	23,960	15,985	39,945	41,311	27,560	68,871
2.9	Busan area improvement	-	-	-	860	90	950	-	-	-	860	90	950	1,483	155	1,638
	Subtotal Category 2	23,305	105	23,410	33,915	1,420	35,335	19,165	15,985	35,150	76,385	17,510	93,895	131,698	30,189	161,887
3.	Way and Structures															
3.1	Rail renewal, 50 kg rails (180 km)	450	1,600	2,050	800	2,840	3,640	-	-	-	1,250	4,440	5,690	2,155	7,655	9,810
3.2	Rail renewal, 60 kg rails (30 km)	-	-	-	-	885	885	210	-	210	210	885	1,095	362	1,526	1,888
3.3	Track renewal, 50 kg rails (50 km)	950	490	1,440	950	740	1,690	475	-	475	2,375	1,230	3,605	4,095	2,121	6,216
3.4	Track renewal, 60 kg rails (60 km)	-	-	-	-	1,770	1,770	2,850	-	2,850	2,850	1,770	4,620	4,914	3,052	7,966
3.5	Concrete sleepers (70,000)	385	-	385	975	-	975	-	-	-	1,360	-	1,360	2,345	-	2,345
3.6	Points and crossings (200)	460	-	460	460	-	460	-	-	-	920	-	920	1,586	-	1,586
3.7	Ballast (70,000 cu m)	140	-	140	340	-	340	-	-	-	480	-	480	828	-	828
3.8	Bridge strengthening (200 spans)	810	-	810	810	-	810	-	-	-	1,620	-	1,620	2,793	-	2,793
3.9	Tunnel strengthening (20 places)	575	-	575	575	-	575	-	-	-	1,150	-	1,150	1,983	-	1,983
3.10	Separation of rail and road at crossings (18 places)	2,075	-	2,075	2,075	-	2,075	-	-	-	4,150	-	4,150	7,155	-	7,155
3.11	Level crossing barriers (20 places)	75	-	75	75	-	75	-	-	-	150	-	150	258	-	258
3.12	Safety sidings (4 places)	-	-	-	275	-	275	-	-	-	275	-	275	474	-	474
3.13	Water supply (10 places)	-	-	-	185	-	185	-	-	-	185	-	185	319	-	319
3.14	Right-of-way improvement	1,125	-	1,125	1,125	-	1,125	-	-	-	2,250	-	2,250	3,879	-	3,879
3.15	Track maintenance equipment	-	-	-	40	2,020	2,060	-	-	-	40	2,020	2,060	69	3,482	3,551
3.16	Track material workshop equipment	-	-	-	2,255	300	2,555	-	-	-	2,255	300	2,555	3,888	517	4,405
	Subtotal Category 3	7,045	2,090	9,135	10,940	8,555	19,495	3,535	-	3,535	21,520	10,645	32,165	37,103	18,353	55,456

	Line	1980 Local	1980 Foreign	1980 Total	1981 Local	1981 Foreign	1981 Total	1982 Local	1982 Foreign	1982 Total	Total 1980-82 Local	Total 1980-82 Foreign	Total 1980-82 Total	Foreign (US$'000) Local	Foreign (US$'000) Foreign	Foreign (US$'000) Total
		(Won million)														
4. Motive Power and Rolling Stock																
4.1 Motive Power																
4.1.1 New diesel locomotives, 3,000 hp (10)		-	-	-	1,050	4,180	5,230	-	-	-	1,050	4,180	5,230	1,810	7,207	9,017
4.1.2 New diesel railcars for long distance (12)		2,335	-	2,335	-	-	-	-	-	-	2,335	-	2,335	4,026	-	4,026
4.1.3 New electric railcars for SMESRS (130)		17,920	-	17,920	28,670	-	28,670	-	-	-	46,590	-	46,590	80,328	-	80,328
4.1.4 New electric railcars for long distance (16)		4,425	-	4,425	-	-	-	-	-	-	4,425	-	4,425	7,629	-	7,629
4.1.5 New breakdown cranes (2)		-	-	-	40	905	945	-	-	-	40	905	945	69	1,560	1,629
4.1.6 Diesel locomotives, remodeling/repair		760	4,400	5,160	760	-	760	-	-	-	1,520	4,400	5,920	2,621	7,586	10,207
4.1.7 Diesel railcars, remodeling/repair (40)		295	-	295	295	-	295	-	-	-	590	-	590	1,017	-	1,017
4.1.8 Heating cars, remodeling/repair (40)		305	-	305	305	-	305	-	-	-	610	-	610	1,052	-	1,052
Subtotal Category 4.1		26,040	4,400	30,440	31,120	5,085	36,205	-	-	-	57,160	9,485	66,645	98,552	16,353	114,905
4.2 Passenger Cars																
4.2.1 New special express coaches (20)		-	-	-	770	3,830	4,600	-	-	-	770	3,830	4,600	1,327	6,604	7,931
4.2.2 New limited express air-conditioned coaches (43)		-	-	-	1,085	5,400	6,485	-	-	-	1,085	5,400	6,485	1,871	9,310	11,181
4.2.3 New limited express air-conditioned dining cars (6)		-	-	-	175	865	1,040	-	-	-	175	865	1,040	302	1,492	1,794
4.2.4 New limited express power source cars (7)		-	-	-	420	2,090	2,510	-	-	-	420	2,090	2,510	724	3,603	4,327
4.2.5 New limited express regular coaches (170)		385	1,910	2,295	2,880	14,325	17,205	-	-	-	3,265	16,235	19,500	5,629	27,991	33,620
4.2.6 Passenger cars, remodeling/repair (110)		95	-	95	95	-	95	-	-	-	190	-	190	328	-	328
4.2.7 Baggage cars, remodeling/repair (30)		-	-	-	245	-	245	-	-	-	245	-	245	422	-	422
Subtotal Category 4.2		480	1,910	2,390	5,670	26,510	32,180	-	-	-	6,150	28,420	34,570	10,603	49,000	59,603
4.3 Freight Cars																
4.3.1 New container cars (100)		-	-	-	-	1,910	1,910	-	-	-	-	1,910	1,910	-	3,293	3,293
4.3.2 Freight cars, remodeling/repair		235	-	235	350	-	350	-	-	-	585	-	585	1,009	-	1,009
Subtotal Category 4.3		235	-	235	350	1,910	2,260	-	-	-	585	1,910	2,495	1,009	3,293	4,302
Subtotal Category 4		26,755	6,310	33,065	37,140	33,505	70,645	-	-	-	63,895	39,815	103,710	110,164	68,646	178,810
5. Rolling Stock and Motive Power Repair Facilities																
5.1 New Daejeon repair shop		-	-	-	7,065	-	7,065	-	-	-	7,065	-	7,065	12,181	-	12,181
5.2 Improvement of Seoul workshop		-	-	-	995	470	1,465	-	-	-	995	470	1,465	1,715	810	2,525
5.3 Improvement of Busan workshop		360	-	360	745	-	745	-	-	-	1,105	-	1,105	1,905	-	1,905
5.4 Improvement of existing sheds		230	-	230	1,870	1,400	3,270	-	-	-	2,100	1,400	3,500	3,621	2,414	6,035
Subtotal Category 5		590	-	590	10,675	1,870	12,545	-	-	-	11,265	1,870	13,135	19,422	3,224	22,646
6. Telecommunications, Power Facilities, Buildings and Others																
6.1 Telecommunications		440	-	440	500	-	500	-	-	-	940	-	940	1,620	-	1,620
6.2 Power facilities		265	-	265	265	-	265	-	-	-	530	-	530	914	-	914
6.3 Buildings		440	-	440	1,330	-	1,330	-	-	-	1,770	-	1,770	3,052	-	3,052
6.4 Housing and hospitals		2,135	-	2,135	1,530	2,320	3,850	-	-	-	3,665	2,320	5,985	6,319	4,000	10,319
6.5 Railroad Research Institute equipment		45	-	45	75	1,245	1,320	-	-	-	120	1,245	1,365	207	2,147	2,354
6.6 Training and technical assistance		-	225	225	-	440	440	-	440	440	-	1,105	1,105	-	1,905	1,905
6.7 Procurement of land and property		560	-	560	560	-	560	-	-	-	1,120	-	1,120	1,931	-	1,931
Subtotal Category 6		3,885	225	4,110	4,260	4,005	8,265	-	440	440	8,145	4,670	12,815	14,043	8,052	22,095
Total Categories 1 - 6		61,580	8,730	70,310	104,260	49,355	153,615	22,700	16,425	39,125	188,540	74,510	263,050	325,068	128,464	453,532
7. Physical contingencies (5% in 1980, 10% in 1981-82, except for 3.1-3.4 and 4)		1,665	20	1,685	6,537	963	7,500	1,917	1,643	3,560	10,119	2,626	12,745	17,447	4,527	21,974
8. Price contingencies (for local currency items 25% in 1980, 15% in 1981 and 10% in 1982; for foreign currency items 10.5% in 1980, 9% in 1981 and 8% in 1982)		7,907	459	8,366	38,066	7,784	45,850	12,540	4,563	17,103	58,513	12,806	71,319	100,885	22,079	122,964
TOTAL PART A		71,152	9,209	80,361	148,863	58,102	206,965	37,157	22,631	59,788	257,172	89,942	347,114	443,400	155,070	598,470
B. Training and Technical Assistance for the Government																
9. Training in transport planning and coordination		-	55	55	-	60	60	-	-	-	-	115	115	-	200	200
10. Technical assistance for transport feasibility studies		-	-	-	-	1,040	1,040	-	700	700	-	1,740	1,740	-	3,000	3,000
11. Technical assistance for urban transport studies		-	-	-	-	600	600	-	910	910	-	1,510	1,510	-	2,600	2,600
TOTAL PART B		-	55	55	-	1,700	1,700	-	1,610	1,610	-	3,365	3,365	-	5,800	5,800
GRAND TOTAL		71,152	9,264	80,416	148,863	59,802	208,665	37,157	24,241	61,398	257,172	93,307	350,479	443,400	160,870	604,270

Table 3.3

KOREA

SEVENTH RAILWAY PROJECT

Loan Financed Items

	Unit	Quantity	Unit cost (US$)	Total cost (US$ M)
A. KNR Project				
1. Rails, 50 kg/m, for renewal	tons	23,000	425	9.77
2. Rails, 60 kg/m, for renewal	tons	10,800	425	4.58
3. Track maintenance equipment				3.48
4. Track material workshop equipment				0.52
5. Breakdown cranes	no.	2	753,000	1.55
6. Passenger Cars				
Special express coaches	no.	20	330,000	6.60
Limited express air cond. coaches	no.	43	216,000	9.30
Limited express air cond. dining cars	no.	6	250,000	1.50
Limited express power source cars	no.	7	515,000	3.60
Limited express regular coaches	no.	170	165,000	28.00
7. Freight cars	no.	100	33,000	3.30
8. Motive power and rolling stock workshop equipment				2.08
9. Training and technical assistance	-	-	-	1.90
Subtotal	-	-	-	76.18
Physical contingencies (10% on items 3, 4, 8 and 9)	-	-	-	0.78
Price contingencies	-	-	-	11.24
Total KNR	-	-	-	88.20
B. Government				
1. Transport sector studies				3.00
2. Urban studies				2.60
3. Training MOT				0.20
Total Government				5.80
Grand Total				94.00

KOREA

SEVENTH RAILWAY PROJECT

KNR Rail Renewal Program, 1977-81 /a
(Track km)

Line	Actual			Plan		Total
	1977	1978	1979	1980	1981	1977-81
Gyeong Bu	17	17	16	-	35	85
Jung Ang	25	30	25	-	30/b	110
Gyeong In	-	-	15	-	-	15
Chung Bug	-	40	-	-	-	40
Gyeong Bug	-	-	-	20	20	40
Dae Gu	25	-	-	-	-	25
Gyeong Weon	-	-	-	20	20	40
Gyeong Jeon	14	-	-	-	21	35
Ho Nam	10	-	-	-	-	10
Jeon Ra	35	-	-	-	-	35
Donghae Nambu	-	20	25	-	-	45
Tae Baeg	15	20	15	-	-	50
Yeong Dong	39	28	29	25	19	140
Total	170	165	125	65	145	670

/a 50 kg rails if not otherwise indicated.

/b 60 kg rails to be laid in 1982.

Source: KNR and mission.

Table 3.5

KOREA

SEVENTH RAILWAY PROJECT

KNR Track Renewal Program, 1977-81 /a
(Track km)

Line	Actual			Plan		Total
	1977	1978	1979	1980	1981	1977-81
Gyeong Bu	-	10	20	20	30/b	80
Jung Ang	-	10	20	-	60/c	90
Gyeong In	8	-	-	-	-	8
Ho Nam	4	-	-	-	-	4
Donghae Nambu	8	10	-	-	-	18
Total	20	30	40	20	90	200

/a 50 kg rails if not otherwise indicated.

/b To be laid in 1982.

/c 60 kg rails to be laid in 1982.

Source: KNR and mission.

Table 3.6

KOREA

SEVENTH RAILWAY PROJECT

Track Maintenance Equipment and Track Material Workshop Machinery

	Quantity	Estimated unit cost	Total cost (US$'000)
Track Maintenance Equipment			
Multiple tie-temper	6	320	1,920
Ballast compactor	3	140	420
Ballast cleaner	1	790	790
Ballast regulator	1	180	180
Ballast dozer	2	35	70
Excavator	2	50	100
Total			3,480
Track Material Workshop Machinery			
Engine lathe	2	25	50
High-speed lathe	1	34	34
Gap lathe	1	40	40
Hobbing machine	1	25	25
Shearing machine	1	20	20
Universal milling machine	1	25	25
Hydraulic press	2	20	40
Slotting machine	1	20	20
Crom hardness processor	1	18	18
Crankshaft grinding machine	1	80	80
Welder	1	10	10
Radial drilling machine	1	20	20
Cylinder boring machine	1	45	45
Cylinder honing machine	1	45	45
Shaping machine	1	25	25
Valve grinding machine	1	18	18
Total			515

Table 3.7

KOREA

SEVENTH RAILWAY PROJECT

Motive Power and Rolling Stock Workshop Equipment

	Quantity	Estimated unit cost (US$'000)	Total cost (US$'000)
Equipment to be Financed from the Loan			
Cylinder boring lathe	2	30	60
Crankshaft grinding machine	1	220	220
Cylinder honing machine	1	150	150
Hobbing machine	1	80	80
Universal milling machine	2	50	100
Universal armature machine for diesel locomotives	1	130	130
Universal armature machine for electric locomotives	1	70	70
Vacuum interrupter valve tester	1	50	50
Vertical turret lathe	2	130	260
Car washer	5	150	750
High potential tester	6	10	60
Air compressor	10	15	150
Total			2,080
Other Equipment			
Wheel press	1	130	130
Fork lift	30	10	300
Overhead travelling crane	1	150	150
Boiler	6	50	300
Tool sets	26	10	260
Total			1,140

KOREA

SEVENTH RAILWAY PROJECT

Financing of Foreign Currency Part of the KNR Project

		1980	1981	1982	Total	IBRD	US Exim Bank	Other sources /a	KFX /b
		US$'000							
2.1	Double tracking Seoul-Suweon rails (4,000 tons)	-	1,716	-	1,716	-	-	-	1,716
2.2	Bypass line Jocheon	-	379	-	379	-	-	-	379
2.3	Additional crossing loops	120	121	-	241	-	-	-	241
2.6	Lengthening of crossing loops	60	78	-	138	-	-	-	138
2.8.2	CTC, Yeongju-Gyeungju	-	-	16,681	16,681	-	-	16,681	-
2.8.3	CTC, Jecheon-Baegsan	-	-	10,879	10,879	-	-	10,879	-
2.9	Busan area improvement	-	155	-	155	-	-	-	155
3.1	Rail renewal, 50 kg rails (18,000 tons)	2,764	4,891	-	7,655	7,655	-	-	-
3.2	Rail renewal, 60 kg rails (3,600 tons)	-	1,526	-	1,526	1,526	-	-	-
3.3	Track renewal, 50 kg rails (5,000 tons)	841	1,280	-	2,121	2,121	-	-	-
3.4	Track renewal, 60 kg rails (7,200 tons)	-	3,052	-	3,052	3,052	-	-	-
3.15	Track maintenance equipment	-	3,482	-	3,482	3,482	-	-	-
3.16	Track material workshop equipment	-	517	-	517	517	-	-	-
4.1.1	New diesel locomotives (20)	-	7,207	-	7,207	-	-	-	7,207
4.1.5	New breakdown cranes (2)	-	1,560	-	1,560	1,560	-	-	-
4.1.6	Diesel locomotives, remodeling	7,586	-	-	7,586	-	7,586	-	-
4.2.1	New special express coaches (20)	-	6,604	-	6,604	6,604	-	-	-
4.2.2	New lim. express air cond. coaches (43)	-	9,310	-	9,310	9,310	-	-	-
4.2.3	New lim. express air cond. dining cars (6)	-	1,492	-	1,492	1,492	-	-	-
4.2.4	New lim. express power source cars (7)	-	3,603	-	3,603	3,603	-	-	-
4.2.5	New lim. express regular cars (170)	3,293	24,698	-	27,991	27,991	-	-	-
4.3.1	New container cars (100)	-	3,293	-	3,293	3,293	-	-	-
5.2 } 5.4 }	Workshop equipment	-	3,224	-	3,224	2,071	-	-	1,153 -
6.4	Hospital equipment	-	4,000	-	4,000	-	-	4,000	-
6.5	Railroad Research Institute equipment	-	2,147	-	2,147	-	-	-	2,147
6.6	Training and technical assistance	387	759	759	1,905	1,905	-	-	-
	Total	15,051	85,094	28,319	128,464	76,182	7,586	31,560	13,136
Physical contingencies		28	1,658	2,832	4,518	778	-	3,156	584
Price contingencies		792	13,420	7,869	22,081	11,240	414	8,322	2,105
	GRAND TOTAL	15,871	100,172	39,020	155,063	88,200	8,000	43,038	15,825

/a OECF (Japan) or other foreign sources to be negotiated or Korean Foreign Exchange.

/b Korean Foreign Exchange - purchased by KNR.

KOREA

SEVENTH RAILWAY PROJECT

Project Execution Schedule

Item		1980 J-F	M-A	M-J	J-A	S-O	N-D	1981 J-F	M-A	M-J	J-A	S-O	N-D	1982 J-F	M-A	M-J	J-A	S-O	N-D
1.2 Gwangyang Industrial Siding																			
Roadbed and structures	- Bidding						-----												
	- Work							----------											
Buildings	- Bidding								-----										
	- Work									----------									
Track	- Bidding									-----									
	- Work										----------								
Signalling	- Bidding								------										
	- Work											-----							
2.1 Double Tracking, Seoul-Suweon																			
Roadbed and structures	- Bidding	/a					-----												
	- Work	----------						----------											
Buildings	- Bidding	-----						-----											
	- Work		----------						----------										
Track	- Bidding			-----						-----									
	- Work				----------						----------								
Electrification	- Bidding					-----													
	- Work								----------										
Signalling	- Bidding						-----												
	- Work									----------									
2.5 Freight Terminal, West Seoul																			
Earthworks & structures	- Bidding							-----											
	- Work									----------									
Buildings	- Bidding										-----								
	- Work											----------							
Track	- Bidding												-----						
	- Work													----------					
Signalling	- Bidding												-----						
	- Work														----------				
2.8.2 CTC Yeongju-Gyeongju																			
Buildings	- Bidding									-----									
	- Work										----------								
Signalling	- Bidding									-----									
	- Work												----------						
Power supply	- Bidding									-----									
	- Work												----------						
Telecommunication	- Bidding									-----									
	- Work												----------						
2.8.3 CTC Jecheon-Baegsan																			
Buildings	- Bidding									-----									
	- Work										----------								
Signalling	- Bidding									-----									
	- Work												----------						
Power supply	- Bidding									-----									
	- Work												----------						
Telecommunication	- Bidding									-----									
	- Work												----------						

Item		1980 J-F	1980 M-A	1980 M-J	1980 J-A	1980 S-O	1980 N-D	1981 J-F	1981 M-A	1981 M-J	1981 J-A	1981 S-O	1981 N-D	1982 J-F	1982 M-A	1982 M-J	1982 J-A	1982 S-O	1982 N-D
3.1-3.4 Rail and Track Renewal																			
1980/81 program (320 km)	- Bidding for rails			----------															
	- Bidding for work				------														
	- Supply of material					----------		----------											
	- Work					----------		----------											
3.10 Separation of Rail and Road at Crossings																			
Construction work	- Bidding	-----						-----											
	- Work		----------						----------										
4.1.1 New Diesel Locomotives																			
Total quantity (10)	- Bidding		-----																
	- Delivery								-----										
4.1.2 New Diesel Railcars for Long Distance																			
Total quantity (12)	- Bidding		-----																
	- Delivery								-----										
4.1.3 New Electric Railcars for SMESRS																			
Total quantity (130)	- Bidding		/a		------														
	- Delivery		----------						----------										
4.1.4 New Electric Railcars for Long Distance																			
Total quantity (16)	- Bidding		/a																
	- Delivery		----------																
4.1.6 Diesel Locomotives, Remodeling																			
Total quantity (40)	- Bidding		/a																
	- Delivery		----------																
	- Installation			----------															
4.2.1 New Special Express Coaches																			
Total quantity (20)	- Bidding			----------															
	- Delivery								----------										
4.2.2-4.2.4 New Limited Express Air-Condition Cars																			
Total quantity (56)	- Bidding			----------					----------										
	- Delivery																		
4.2.5 New Limited Express Regular Coaches																			
Total quantity (170)	- Bidding		----------																
	- Delivery					----------		----------											
5.1 New Daejeon Repair Shop																			
Buildings	- Bidding						------												
	- Work							----------											
Equipment	- Bidding					------													
	- Delivery								----------										
	- Installation									----------									

/a Bidding in 1979.

KOREA

SEVENTH RAILWAY PROJECT

Procurement Schedule for Bank-financed Items

	Events /a						
	I	II	III	IV	V	VI	VII
Rails (33,800 tons)	04/15/80	05/01/80	06/15/80	07/15/80	08/01/80	12/01/80	12/01/81
Track maintenance equipment	07/15/80	08/01/80	09/15/80	10/15/80	11/01/80	03/01/81	05/01/81
Track material workshop equipment	11/15/80	12/01/80	01/15/81	02/15/81	03/01/81	07/01/81	10/01/81
Breakdown cranes (2)	06.15.80	07/01/80	08/15/80	09/15/80	10/01/80	10/01/81	10/01/81
Passenger Cars							
Special express cars (20)	06/15/80	07/01/80	08/15/80	09/15/80	10/01/80	04/01/81	07/01/81
Limited express air cond. cars (56)	06/15/80	07/01/80	08/15/80	09/15/80	10/01/80	04/01/81	07/01/81
Limited express regular cars (170)	04/15/80	05/01/80	06/15/80	07/15/80	08/01/80	12/01/80	07/01/81
Freight Cars							
Container cars (100)	06/15/80	07/01/80	08/15/80	09/15/80	10/01/80	04/01/81	04/01/81
Rolling stock workshop equipment	08/15/80	09/01/80	10/15/80	11/15/80	04/01/80	04/01/81	07/01/81

/a I - Bank's comments on tender documents, II - bid invitation, III - bid opening (price quotation), IV - Bank's agreement to award of contract, V - contract date, VI - start of delivery, VII - completion of delivery.

Table 3.11

KOREA

SEVENTH RAILWAY PROJECT

Estimated Disbursement Schedule /a

IBRD fiscal years & quarter	Quarter	Cumulative
	US$ million	
1980/81		
To September 30, 1980	0.2	0.2
To December 31, 1980	7.3	7.5
To March 31, 1981	14.5	22.0
To June 30, 1981	30.0	52.0
1981/82		
To September 30, 1981	22.0	74.0
To December 31, 1981	10.0	84.0
To March 31, 1982	3.5	87.5
To June 30, 1982	2.0	89.5
1982/83		
To September 30, 1982	1.5	91.0
To December 31, 1982	1.5	92.5
To March 31, 1983	1.0	93.5
To June 30, 1983	0.5	94.0

/a Based on procurement assumptions as follows:

	Bid invitation date	Contract date
Limited express regular cars	05/01/80	08/01/80
Rails	05/01/80	08/01/80
Other rolling stock	07/01/80	10/01/80
Track maintenance equipment	08/01/80	11/01/80
Rolling stock workshop equipment	09/01/80	12/01/80
Track material workshop equipment	12/01/80	03/01/81

Table 4.1

KOREA

SEVENTH RAILWAY PROJECT

Grouping of Project Capital Costs for Economic Analysis

	Million won	Percent
Capacity Increases		
a. Long Distances		
Lines	59,780	
Motive power	20,055	
Rolling stock - Passenger	34,570	
- Freight	2,495	
New repair facilities	7,065	
Telecommunications and power	1,470	
Subtotal	125,435	47.7
b. Seoul Urban Services (SMESRS)		
Lines	32,610	
Rolling stock	46,590	
Subtotal	79,200	30.1
Way and Structures Renewal	25,155	9.6
Miscellaneous		
Industrial sidings, part of larger industrial development projects	7,330	
Safety-related investments (including rail/road crossing, right-of-way improvement)	8,515	
Workshop improvements	6,070	
Buildings, housing, hospital, land acquisition	8,875	
Training, technical assistance, research	2,470	
Subtotal	33,260	12.6
Total	263,050	100.0

March 1980

Table 4.2

KOREA

SEVENTH RAILWAY PROJECT

Allocation of Project Capital Costs of Capacity Increases
Between Passenger and Freight Services
(In million won)

	Passenger			Freight		
	1980	1981	1982	1980	1981	1982
1. Lines						
Jecheon bypass	-	230	-	-	935	-
New and extended loops and yards	3,200	3,535	-	440	1,415	-
West Seoul freight terminal	-	-	-	-	2,530	3,940
Station installations	1,540	3,015	-	270	270	-
CTC, Jung Ang line	-	690	5,820	-	1,610	13,525
CTC, Tae Baeg line	-	460	2,385	-	1,840	9,480
Other signaling	760	1,560	-	100	210	-
Subtotal	5,520	9,490	8,205	810	8,810	26,945
2. Motive Power and Rolling Stock						
New diesel locomotives	-	5,020	-	-	210	-
New long-distance railcars	6,760	-	-	-	-	-
Remodeled locomotives	3,450	510	-	1,715	250	-
Remodeled cars	400	400	-	200	200	-
Breakdown crane	-	845	-	-	100	-
Cars (passenger and freight)	2,390	32,180	-	235	2,270	-
Subtotal	13,000	38,955	-	2,150	3,030	-
3. New Repair Facilities	-	6,220	-	-	845	-
4. Telecommunications and Power	620	670	-	85	95	-
Total by Year	19,140	55,335	8,205	3,040	12,770	26,945
Total Project	125,435 (from Table 4.1)					
Plus 10% physical contingencies on 1, 3 and 4	615	1,640	820	90	985	2,700
For economic analysis (rounded)	19,800	57,000	9,000	3,100	13,800	29,600
In % of total passenger/freight		66		34		

March 1980

Table 4.3

KOREA

SEVENTH RAILWAY PROJECT

1979 Comparative Freight Transport Costs by Alternative Modes

	Total	Variable	Fixed
	-- (Won per ton-km) --		
A. Rail Transport Costs (Line Haul)			
Coal	7.75	5.58	2.17
Cement	7.88	5.87	2.01
All freight (average)	8.09	5.70	2.39
B. Road Transport Costs /a			
Light Truck (2.5 tons)			
On gravel roads at 201.95 won/km	107.70		
On paved roads at 110.99 won/km	59.20		
Heavy Truck (8-10 tons)			
On gravel roads at 354.56 won/km	52.50		
On paved roads at 182.44 won/km	27.00		
C. Coastal Shipping Transport Cost			
Typical dry cargo, 900-ton vessel	13.06	5.07	7.99

/a Assuming operation at 75% of capacity.

Sources:

A. KNR.

B. Study of National and Provincial Road Networks, Economic Vehicle Operating Costs, updated to mid-1979 prices for PCR of Second Highway Project (Loan 956-KO).

C. Technical and Economic Feasibility Studies of Major KNR Investments, 1980-81, Draft Final Report, August 1979, Table 4.9.

Table 4.4

KOREA

SEVENTH RAILWAY PROJECT

Economic Return on Capacity Increases for Freight Services

	Capital costs (W million) /a	Traffic that would otherwise divert to other modes without project /b (Million ton-km)	Economic cost savings from alternative mode /c (W million)
1980	3,100	-	-
1981	13,800	-	-
1982	29,600	-	-
1983-2007	-	850	17,000
			Rate of Return is 33%

/a Includes investment in lines, motive power and rolling stock, new repair facilities, telecommunications and power (see detailed allocation in Table 4.2).

/b This is taken conservatively as two thirds of the freight traffic increase from 1979 to 1982. The remaining traffic increase is assumed to be handled by improvement in use of existing facilities. Assuming that only one third of the freight traffic increase would divert to other modes without the project would reduce the rate of return to an acceptable 17%.

/c Difference between transport cost by rail and the least costly alternative. This is generally road transport since coastal shipping is only competitive for traffic with origins and destinations at or near ports and this has already been taken into account when forecasting railway traffic. An average of W 20 per ton-km is assumed as the cost difference (see Table 4.3). This assumes a terminal cost for rail operations of W 1,200 per ton, and a road cost which is a weighted average of heavy truck costs on paved and gravel roads (3/4 paved and 1/4 gravel).

Table 4.5

KOREA

SEVENTH RAILWAY PROJECT

1979 Comparative Passenger Transport Costs by Alternative Modes

	Revenues	Costs		
		Total	Variable	Fixed
	(Won per ton-km)			
A. Revenues and Costs of Rail Transport				
Special Express	14.30	5.29	4.57	0.72
Limited Express				
Air-conditioned	11.06	4.08	2.72	1.36
Non air-conditioned	6.89	2.93	2.02	0.91
B. Bus Transport				
On Gravel Roads				
Won/km	241.40			
with:	30 pass.	40 pass.	50 pass.	
Won/pass.-km	8.05	6.35	4.83	
On Paved Roads				
Won/km	140.86			
with:	30 pass.	40 pass.	50 pass.	
Won/pass.-km	4.70	3.52	2.82	

Source: A. KNR.

B. Study of National and Provincial Road Networks, Economic Vehicle Operating Costs, updated to mid-1979 prices for PCR of Second Highway Project (Loan 956-KO).

Table 4.6

KOREA

SEVENTH RAILWAY PROJECT

Financial Return on Capacity Increases for Passenger Services

	Capital Costs /a (W million)	Capacity added by the Project /b: Special Express	Limited Express: AC	Limited Express: non-AC	Operating Profits /c: Special Express	Limited Express: AC	Limited Express: non-AC	Total
		(million pass.-km)			(Won million)			
1980	19,800	-	-	160	-	-	640	640
1981	57,000	94	285	1,130	846	1,995	4,520	7,361
1982	9,000	192	603	1,980	1,728	4,221	7,920	13,869
1983-2007	-	192	603	1,980	1,728	4,221	7,920	13,869

Rate of return is 17%

/a Include invesments in lines, motive power and rolling stock, new repair facilities, telecommunications and power (see detailed allocation in Table 4.2).

/b Capacity resulting from acquisition of new coaches; calculation includes improvement in utilization of both existing and added stock.

/c Difference between total operating costs and revenues, i.e.,
Special express ..... 9 Won/pass.-km
Limited express, air conditioned..... 7 Won/pass.-km
Limited express, non air conditioned.. 4 Won/pass.-km

Table 4.7

KOREA

SEVENTH RAILWAY PROJECT

Economic Return on Capacity Increases for Seoul Surburban Services

Year	Capital Costs /a			Traffic that would divert to buses without project /b	Economic cost savings from alternative mode /b
	Line	Railcars	Total	(million pass-km)	(W billion)
	-----	(W million)	-----		--
1978	3,516	-	3,516	-	-
1979	8,254	-	8,254	-	-
1980	15,400	17,920	33,320	1,000	6.0
1981	15,390	28,670	44,060	2,000	12.0
1982	-	-	-	2,685	16.1

Rate of return is 19%

/a Includes investment for the entire quadrupling of the Seoul-Suweon line started under the sixth project and to be completed under this project, and 130 electric railcars to be acquired in 1980 and 1981.

/b Traffic forecasts (Table 2.10) are greater than the capacity provided by the added railcars implying a general increase in utilization of the entire fleet. The figures above reflect the share of total traffic that will be handled by the new cars assuming uniform utilization for all cars in the fleet.

/c Difference between cost by rail and cost by bus. This is conservative as, without the project, some trips may divert to taxis and cars at higher costs. Costs of urban buses in Seoul are estimated at some W 10/passenger-km while costs of SMERS for 1979 were W 4/passenger-km.

KOREA

SEVENTH RAILWAY PROJECT

KOREAN NATIONAL RAILROAD (KNR)

Consolidated Income Statement
(Won billion)

	1977 Audited	1978 Audited	1979 Estimate	1980 Revised budget	1981 Forecast	1982 Forecast	1983 Forecast	1984 Forecast	1985 Forecast	1986 Forecast	Total 1980-86
Operating revenue											
A				254.9	286.7	321.5	356.1	387.4	418.7	449.6	2,474.9
B	134.3	166.1	208.4	316.2	421.9	506.2	604.9	684.7	772.4	876.1	4,182.4
Working cost											
A			184.0	200.8	212.2	224.2	237.0	244.4	251.7	262.4	1,632.7
B	119.3	142.8	184.0	258.2	321.9	387.0	459.8	520.8	588.9	672.8	3,209.4
Depreciation	17.3	20.5	21.2	24.9	29.5	34.6	39.9	44.9	50.3	56.0	280.1
Total operating costs	136.6	163.3	205.2	283.1	351.4	421.6	499.7	565.7	639.2	728.8	3,489.5
Net operating revenue (loss)	(2.3)	2.8	3.2	33.1	70.5	84.6	105.2	119.0	133.2	147.3	692.9
Net nonoperating revenue (loss)	(1.4)	(1.3)	3.2	1.3	1.5	1.6	1.8	1.9	2.1	2.4	12.6
Interest charges	16.3	23.8	29.2	40.6	51.7	64.6	75.9	86.1	94.4	100.3	513.6
Net income (loss)	(20.0)	(22.3)	(22.8)	(6.2)	20.3	21.6	31.1	34.8	40.9	49.4	191.9
Exchange loss (profit)	-	-	-	3.7	3.6	4.0	4.2	4.1	3.8	3.6	27.0
Government subsidy against operating losses	21.7	21.4	21.8	25.8	-	-	-	-	-	-	25.8
Book profit (loss)	1.7	(0.9)	(1.0)	15.9	16.7	17.6	26.9	30.7	37.1	45.8	190.7

Note: Lines A: Revenues and costs in constant 1979 Won.
Lines B: Revenues and costs in current Won.

Table 5.2

KOREA

SEVENTH RAILWAY PROJECT

Korean National Railroad (KNR)

Operating Revenue Consolidated
(W Billion)

	Passengers		Baggage		Freight		Other		Total	
	A	B	A	B	A	B	A	B	A	B
1977	67.4	-	3.8	-	58.8	-	4.3	-	134.3	-
1978	87.6	-	4.3	-	65.1	-	9.1	-	166.1	-
1979	119.5	119.5	6.1	6.1	75.6	75.6	7.2	7.2	208.4	208.4
1980	155.2	192.5	6.6	8.2	81.0	100.5	12.1	15.0	254.9	316.2
1981	180.9	266.2	6.8	10.0	84.6	124.5	14.4	21.2	286.7	421.9
1982	210.1	324.4	6.9	10.6	87.3	142.9	17.2	28.3	321.5	506.2
1983	236.4	390.5	7.2	11.9	91.9	165.4	20.6	37.1	356.1	604.9
1984	260.4	449.7	7.4	12.8	94.8	179.2	24.8	43.0	387.4	684.7
1985	283.7	505.8	7.6	13.7	98.4	195.3	29.0	57.6	418.7	772.4
1986	304.9	569.2	7.8	14.6	102.2	218.1	34.7	74.2	449.6	876.1

Columns A: Actuals through 1979, based on December 31, 1979, tariffs thereafter.
Columns B: Based on planned increases over December 31, 1979, tariffs.

Table 5.3

KOREA

SEVENTH RAILWAY PROJECT

KOREAN NATIONAL RAILROAD (KNR)

Working Costs
(Won billion)

		1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	Total 1980-86
Maintenance of Permanent Way												
Staff	A			14.1	14.8	15.3	15.9	16.4	16.7	17.1	17.3	113.5
	B	8.7	11.1	14.1	17.7	22.0	26.3	31.2	34.9	39.4	43.8	215.3
Materials: fuel	A											
	B											
Materials: other	A			14.0	14.4	14.8	15.2	15.4	15.6	15.8	16.0	107.2
	B	8.1	12.0	14.0	18.0	21.4	24.0	26.7	29.6	32.7	36.0	188.4
Other costs	A			2.5	2.4	2.7	2.9	3.4	3.5	3.6	4.3	22.8
	B	0.5	0.2	2.5	3.4	4.2	5.0	5.9	6.6	7.4	9.7	42.2
Subtotal - Maintenance of Permanent Way	A			30.6	31.6	32.8	34.0	35.2	35.8	36.5	37.6	243.5
	B	17.3	23.3	30.6	39.1	47.6	55.3	63.8	71.1	79.5	89.5	445.9
Maintenance of Motive Power												
Staff	A			9.7	10.0	10.2	10.6	10.9	11.1	11.2	11.3	75.3
	B	5.7	6.9	9.7	12.0	14.7	17.6	20.8	23.2	25.9	28.6	142.8
Materials: fuel	A											
	B											
Materials: other	A			11.8	12.5	13.1	13.6	14.1	14.4	14.7	14.9	97.3
	B	8.8	9.9	11.8	15.6	18.8	21.5	24.5	27.4	30.4	33.6	171.8
Other costs	A			1.7	1.6	1.8	1.9	2.3	2.3	2.4	2.8	15.1
	B	1.8	1.2	1.7	2.3	2.8	3.3	3.9	4.4	4.9	6.4	28.0
Subtotal - Maintenance of Motive Power	A			23.2	24.1	25.1	26.1	27.3	27.8	28.3	29.0	187.7
	B	16.3	18.0	23.2	29.9	36.3	42.4	49.2	55.0	61.2	68.6	342.6
Maintenance of Rolling Stock												
Staff	A			17.0	17.6	18.1	18.7	19.2	19.3	19.7	19.9	132.5
	B	9.3	12.1	17.0	21.2	26.0	31.1	36.5	40.3	45.3	50.3	250.7
Materials: fuel	A											
	B											
Materials: other	A			5.3	5.5	5.7	5.9	6.1	6.3	6.5	6.6	42.6
	B	4.6	3.7	5.3	6.9	8.2	9.3	10.6	11.9	13.4	14.9	75.2
Other costs	A			3.0	2.8	3.1	3.4	4.0	4.0	4.1	5.0	26.4
	B	1.7	1.6	3.0	4.1	5.0	5.9	6.9	7.6	8.6	11.2	49.3
Subtotal - Maintenance of Rolling Stock	A			25.3	25.9	26.9	28.0	29.3	29.6	30.3	31.5	201.5
	B	15.6	17.4	25.3	32.2	39.2	46.3	54.0	59.8	67.3	76.4	375.2
Transportation												
Staff	A			45.0	49.4	53.8	57.8	61.5	64.0	66.6	68.3	421.4
	B	27.9	34.6	45.0	59.4	77.4	95.9	116.8	133.8	153.1	172.8	809.2
Materials: fuel	A			26.3	35.7	37.5	40.1	42.6	44.8	46.7	48.6	296.0
	B	15.9	18.0	26.3	53.8	67.6	82.9	101.3	117.0	134.0	153.3	709.9
Materials: other	A											
	B											
Other costs	A			7.9	8.0	9.3	10.5	12.6	13.4	14.0	17.0	84.8
	B	7.2	8.4	7.9	11.5	14.8	18.2	22.1	25.4	29.0	38.3	159.3
Subtotal - Transportation	A			79.2	93.1	100.6	108.4	116.7	122.2	127.3	133.9	802.2
	B	51.0	61.0	79.2	124.7	159.8	197.0	240.2	276.2	316.1	364.4	1,678.4
General Expenses												
Staff	A			18.0	18.3	18.5	19.0	19.1	19.3	19.3	19.5	133.0
	B	11.8	14.3	18.0	21.9	26.7	31.6	36.2	40.3	44.3	49.3	250.3
Materials: fuel	A											
	B											
Materials: other	A			4.7	4.9	5.1	5.3	5.5	5.7	5.9	6.0	38.4
	B	4.2	4.3	4.7	6.2	7.3	8.4	9.6	10.8	12.1	13.6	68.0
Other costs	A			3.0	2.9	3.2	3.4	3.9	4.0	4.1	4.9	26.4
	B	3.1	4.5	3.0	4.2	5.0	6.0	6.8	7.6	8.4	11.0	49.0
Subtotal - General Expenses	A			25.7	26.1	26.8	27.7	28.5	29.0	29.3	30.4	197.8
	B	19.1	23.1	25.7	32.3	39.0	46.0	52.6	58.7	64.8	73.9	367.3
Total Working Costs												
Staff	A			103.8	110.1	115.9	122.0	127.1	130.4	133.9	136.3	875.7
	B	63.4	79.0	103.8	132.2	166.8	202.5	241.5	272.5	308.0	344.8	1,668.5
Materials: fuel	A			26.3	35.7	37.5	40.1	42.6	44.8	46.7	48.6	296.0
	B	15.9	18.0	26.3	53.8	67.6	82.9	101.3	117.0	134.0	153.3	709.9
Materials: other	A			35.8	37.3	38.7	40.0	41.1	42.0	42.9	43.5	285.5
	B	25.7	29.9	35.8	46.7	55.7	63.2	71.4	79.7	88.6	98.1	503.4
Other costs	A			18.1	17.7	20.1	22.1	26.2	27.2	28.2	34.0	175.5
	B	14.3	15.9	18.1	25.5	31.8	38.4	45.6	51.6	58.3	76.6	327.8
Grand Total Working Costs	A			184.0	200.8	212.2	224.2	237.0	244.4	251.7	262.4	1,632.7
	B	119.3	142.8	184.0	258.2	321.9	387.0	459.8	520.8	588.9	672.8	3,209.4

Lines A: Constant end 1979 costs.
Lines B: Inflated costs.

KOREA

SEVENTH RAILWAY PROJECT

KOREAN NATIONAL RAILROAD (KNR)

Valuation of Fixed Assets and Depreciation
(Won billion)

	1978 Actual	1979 Estimated	1980 Budget	1981 Forecast	1982 Forecast	1983 Forecast	1984 Forecast	1985 Forecast	1986 Forecast
Calculation of Gross Values									
Balance at beginning of year:									
in use	1,037.6	1,107.8	1,181.8	1,397.9	1,721.2	1,961.6	2,213.8	2,486.6	2,764.6
in progress	18.0	38.4	107.9	60.6	9.2	28.8	24.4	28.5	40.7
Reevaluation 5% of balance in use	28.6	55.4	59.1	69.9	86.1	98.1	110.7	124.3	138.2
Addition during year	59.7	125.8	156.7	288.6	248.4	213.9	237.4	237.0	216.6
Less retirements during year:									
30% of annual addition	(2.3)	(37.7)	(47.0)	(86.6)	(74.5)	(64.2)	(71.2)	(71.1)	(65.0)
Total Gross Value of Fixed Assets	1,146.2	1,289.7	1,458.5	1,730.4	1,990.4	2,238.2	2,515.1	2,805.3	3,095.1
of which in progress (Tables C5 No. 13-16)	38.4	107.9	60.6	9.2	28.8	24.4	28.5	40.7	53.0
Gross Value in Use	1,107.8	1,181.8	1,397.9	1,721.2	1,961.6	2,213.8	2,486.6	2,764.6	3,042.1
of which Land	234.3	241.0	282.1	349.1	395.0	445.4	498.7	550.7	601.6
Gross Value of Depreciable Assets	873.5	940.8	1,115.8	1,372.1	1,566.6	1,768.4	1,987.9	2,213.9	2,440.5
Calculation of Annual & Cumulated Depreciation									
Gross value of depreciable assets as above	873.5	940.8	1,115.8	1,372.1	1,566.6	1,768.4	1,987.9	2,213.9	2,440.5
Less 50% of annual increase	-	(62.9)	(78.4)	(144.3)	(124.2)	(107.0)	(118.3)	(118.5)	(108.3)
Value for annual depreciation	873.5	877.9	1,037.4	1,227.8	1,442.4	1,661.4	1,869.6	2,095.4	2,332.2
Annual Depreciation: 2.4% of above	20.5	21.2	24.9	29.5	34.6	39.9	44.9	50.3	56.0
Less Accrued depreciation on revalued assets:									
20% of annual depreciation	-	(4.2)	(5.0)	(5.9)	(6.9)	(8.0)	(9.0)	(10.1)	(11.2)
Net annual depreciation	20.5	17.0	19.9	23.6	27.7	31.9	35.9	40.2	44.8
Cumulated depreciation brought forward	209.0	229.5	246.5	266.4	290.0	317.7	349.6	385.5	425.7
Acumulated Depreciation	229.5	246.5	266.4	290.0	317.7	349.6	385.5	425.7	470.5

Table 5.5

KOREA

SEVENTH RAILWAY PROJECT

KOREAN NATIONAL RAILROAD (KNR)

Cash Flow Statement
(Current Won billion)

	1977 Audited	1978 Audited	1979 Estimate	1980 Revised budget	1981 Forecast	1982 Forecast	1983 Forecast	1984 Forecast	1985 Forecast	1986 Forecast	Total 1980-86
SOURCES OF FUNDS											
Cash Generated by KNR											
Gross operating revenue	134.3	166.1	208.4	316.2	421.9	506.2	604.9	684.7	772.4	876.1	4,182.4
Less Working expenses	119.3	142.8	184.0	258.2	321.9	387.0	459.8	520.8	588.9	672.8	3,209.4
Subtotal Cash Generated from Operations	15.0	23.3	24.4	58.0	100.0	119.2	145.1	163.9	183.5	203.3	973.0
Add Loss on exchange fluctuations	0.4										
Provision for severance pay	(0.5)	3.0	1.8								
Other nonoperating revenue	(1.4)	(0.7)	3.2	1.3	1.5	1.6	1.8	1.9	2.1	2.4	12.6
Sale of assets	3.1	2.6	6.4	8.5	9.0	10.0	11.0	12.0	13.0	14.0	77.5
Total Cash Generated by KNR	16.6	28.2	35.8	67.8	110.5	130.8	157.9	177.8	198.6	219.7	1,063.1
Subsidies											
Gov't against operating losses	21.7	21.4	21.8	25.8							25.8
Gov't for investments started prior to 1980	0.8	-	27.4	21.9	48.1						70.0
Gov't for 1980-81 plan				0.3	13.3						13.6
Gov't for 1982-86 plan						48.8	35.2	39.2	64.8	62.3	250.3
Total Subsidies	22.5	21.4	49.2	48.0	61.4	48.8	35.2	39.2	64.8	62.3	359.7
Borrowing											
For investment started prior to 1980											
Foreign	25.0	25.3	46.1	28.4							28.4
Local	24.0	35.0	47.5	25.9	33.3						59.2
For 1980-81 investment plan											
Foreign				9.1	57.9	22.4					89.4
Local				43.7	129.9	27.8					201.4
For 1982-86 investment plan											
Foreign						45.0	49.1	60.1	46.2	38.7	239.1
Local						94.7	120.0	137.5	104.3	131.2	587.7
Subtotal: Foreign	25.0	25.3	46.1	37.5	57.9	67.4	49.1	60.1	46.2	38.7	356.9
Local	24.0	35.0	47.5	69.6	163.2	122.5	120.0	137.5	104.3	131.2	848.3
Total Borrowing	49.0	60.3	93.6	107.1	221.1	189.9	169.1	197.6	150.5	169.9	1,205.2
GRAND TOTAL SOURCES OF FUNDS	88.1	109.9	178.6	222.9	393.0	369.5	362.2	414.6	413.9	451.9	2,628.0
APPLICATION OF FUNDS											
Investments											
Started prior to 1980											
Foreign	21.3	25.3	46.1	28.5							28.5
Local	44.1	34.4	80.6	47.8	81.5						129.3
1980-81 plan											
Foreign				9.1	57.9	22.4					89.4
Local				71.3	149.2	37.5					258.0
1982-86 plan											
Foreign						45.0	49.1	60.1	46.2	38.7	239.1
Local						143.5	164.8	177.3	190.8	177.9	854.3
Subtotal: Foreign	21.3	25.3	46.1	37.6	57.9	67.4	49.1	60.1	46.2	38.7	357.0
Local	44.1	34.4	80.6	119.1	230.7	181.0	164.8	177.3	190.8	177.9	1,241.6
Total Investments	65.4	59.7	126.7	156.7	288.6	248.4	213.9	237.4	237.0	216.6	1,598.6
Debt Service											
On loans outstanding as of 12/31/78: Interest	16.3	23.8	29.2	33.0	31.6	29.4	26.9	24.4	21.9	19.6	186.8
Repayment	15.0	19.5	25.5	28.6	33.1	35.3	34.7	33.1	29.0	29.0	222.8
On loans contracted or planned between 1979 & 81: Interest				7.6	20.1	28.7	29.6	28.6	26.2	24.1	164.9
Repayment				1.3	1.3	6.3	16.1	27.6	28.2	29.0	109.8
On loans for 1982-86 investment plan: Interest						6.5	19.4	33.1	46.3	56.6	161.9
Repayment							6.0	6.0	27.7	28.0	67.7
Subtotals: Interest	16.3	23.8	29.2	40.6	51.7	64.6	75.9	86.1	94.4	100.3	513.6
Repayment	15.0	19.5	25.5	29.9	34.4	41.6	56.8	66.7	84.9	86.0	400.3
Total Debt Service	31.3	43.3	54.7	70.5	86.1	106.2	132.7	152.8	179.3	186.3	913.9
GRAND TOTAL APPLICATION OF FUNDS	96.7	103.0	181.4	227.2	374.7	354.6	346.6	390.2	416.3	402.9	2,512.5
Annual Variation in Working Capital	(8.6)	6.9	(2.8)	(4.3)	18.3	14.9	15.6	24.4	(2.4)	49.0	115.5
Working Capital Brought Forward	4.9	(3.7)	3.2	0.4	(3.9)	14.4	29.3	44.9	69.3	66.9	0.4
Working Capital At End of Year	(3.7)	3.2	0.4	(3.9)	14.4	29.3	44.9	69.3	66.9	115.9	115.9

Table 5.6

KOREA

SEVENTH RAILWAY PROJECT

KOREAN NATIONAL RAILROAD (KNR)

Balance Sheet
(Current Won billion)

As of December 31,	1977 audited	1978 audited	1979 estimate	1980 forecast	1981 forecast	1982 forecast	1983 forecast	1984 forecast	1985 forecast	1986 forecast
ASSETS										
Current Assets										
Cash	6.2	8.7	7.7	(7.0)	10.2	21.1	41.3	71.4	81.1	122.8
Accounts Receivable	6.7	9.3	12.4	17.4	20.8	23.8	27.6	29.9	32.6	36.4
Inventories	15.1	22.0	21.0	40.7	49.4	57.5	66.9	75.8	84.7	95.5
Other current assets	1.2	2.9	4.7	9.0	18.6	20.0	20.0	20.0	20.0	20.0
Subtotal Current Assets	29.2	42.9	45.8	60.1	99.0	122.4	155.8	197.1	218.4	274.7
Current Liabilities										
Accounts payable	12.4	11.4	15.1	21.0	25.8	30.7	36.3	41.3	46.8	54.7
Current maturities	15.5	19.5	21.5	29.9	34.4	41.6	56.8	66.7	84.9	86.0
Other current liabilities	5.0	8.8	8.8	13.1	24.4	20.8	17.8	19.8	19.8	18.1
Subtotal Current Liabilities	32.9	39.7	45.4	64.0	84.6	93.1	110.9	127.8	151.5	158.8
Total Net Working Capital	(3.7)	3.2	0.4	(3.9)	14.4	29.3	44.9	69.3	66.9	115.9
FIXED ASSETS										
In use land	225.3	234.3	241.0	282.1	349.1	395.0	445.4	498.7	550.7	601.6
In use other fixed assets	812.3	873.5	940.8	1,115.8	1,372.1	1,566.6	1,768.4	1,987.9	2,213.9	2,440.5
Subtotal Gross Book Value of Fixed Assets	1,037.6	1,107.8	1,181.8	1,397.9	1,721.2	1,961.6	2,213.8	2,486.6	2,764.6	3,042.1
Accumulated depreciation	209.0	229.5	246.5	266.4	290.0	317.7	349.6	385.5	425.7	470.5
Subtotal Net Fixed Assets in Use	828.6	878.3	935.3	1,131.5	1,431.2	1,643.9	1,864.2	2,101.1	2,338.9	2,571.6
Work in progress	18.0	38.4	107.9	60.6	9.2	28.8	24.4	28.5	40.7	53.0
Total Net Fixed Assets	846.6	916.7	1,043.2	1,192.1	1,440.4	1,672.7	1,888.6	2,129.6	2,379.6	2,624.6
OTHER ASSETS										
Miscellaneous other assets	3.2	3.3	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Deferred loss on exchange fluctuations	33.0	51.2	51.2	51.2	51.2	51.2	51.2	51.2	51.2	51.2
Total Other Assets	36.2	54.5	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4
GRAND TOTAL ASSETS	879.1	974.4	1,099.0	1,243.6	1,510.2	1,757.4	1,988.9	2,254.3	2,501.9	2,795.9
LIABILITIES										
Long-Term Debt										
Loan capital	286.1	351.4/a	419.5	500.4	690.7	843.0	959.5	1,094.5	1,163.9	1,251.4
Provision for severance pay	3.2	6.2	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Total Long-Term Debt	289.3	357.6	427.5	508.4	698.7	851.0	967.5	1,102.5	1,171.9	1,259.4
Equity Equivalent										
Opening capital	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.5
Subsidies for investments	10.5	9.9	37.3	59.5	120.9	169.7	204.9	244.1	308.9	371.2
Revaluation reserve	508.1	539.8	567.5	597.0	632.0	675.1	724.1	779.5	841.6	910.7
Accumulated surplus (loss)	(12.0)	(51.2)	(73.4)	(87.2)	(107.3)	(104.3)	(73.5)	(37.7)	13.6	88.7
Subsidies against operating losses	21.7	56.8	78.6	104.4	104.4	104.4	104.4	104.4	104.4	104.4
Total Equity Equivalent	589.8	616.8	671.5	735.2	811.5	906.4	1,021.4	1,151.8	1,330.0	1,536.5
GRAND TOTAL LIABILITIES	879.1	974.4	1,099.0	1,243.6	1,510.2	1,757.4	1,988.9	2,254.3	2,501.9	2,795.9

/a Includes impact of currency exchange fluctuation for W 24.5 billion, included in deferred loss under "Other Assets".

KOREA

SEVENTH RAILWAY PROJECT

KOREAN NATIONAL RAILROAD (KNR)

Calculation of Equity Equivalent
(Won billion)

	1977 Audited	1978 Audited	1979 Estimate	1980 Budget	1981 Forecast	1982 Forecast	1983 Forecast	1984 Forecast	1985 Forecast	1986 Forecast
Opening Capital	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.5
Subsidies for Capital Investments										
Balance brought forward	9.7	10.5	9.9	37.3	59.5	120.9	169.7	204.9	244.1	308.9
Add Increase in year	0.8	(0.6)	27.4	22.2	61.4	48.8	35.2	39.2	64.8	62.3
Balance at end of year	10.5	9.9	37.3	59.5	120.9	169.7	204.9	244.1	308.9	371.2
Revaluation of Assets										
Balance brought forward	495.2	511.2	539.8	567.5	597.0	632.0	675.1	724.1	779.5	841.6
Add 50% of gross value of revaluation of fixed assets	16.0	28.6	27.7	29.5	35.0	43.1	49.0	55.4	62.1	69.1
Balance at end of year	511.2	539.8	567.5	597.0	632.0	675.1	724.1	779.5	841.6	910.7
Accrued Surplus										
Balance brought forward	(18.8)	(28.8)	(51.2)	(73.4)	(87.2)	(107.3)	(104.3)	(73.5)	(37.7)	13.6
Add Net annual revenues (Loss)	(20.0)	(22.3)	(22.8)	(9.9)	16.7	17.6	26.9	30.7	37.1	45.8
Deduct Retirement of assets	(3.1)	(2.7)	(37.7)	(47.0)	(86.6)	(74.5)	(64.2)	(71.2)	(71.1)	(65.0)
Add Accrued depreciation on retired assets	-	-	4.2	5.0	5.9	6.9	8.0	9.0	10.1	11.2
Add Sales of assets	3.1	2.6	6.4	8.5	9.0	10.0	11.0	12.0	13.0	14.0
Add 50% of gross value of revaluation of fixed assets	-	-	27.7	29.6	34.9	43.0	49.1	55.3	62.2	69.1
Balance at end of year	(28.8)	(51.2)	(73.4)	(87.2)	(107.3)	(104.3)	(73.5)	(37.7)	13.6	88.7
Subsidies Against Operating Losses										
Balance brought forward	13.7	35.4	56.8	78.6	104.4	104.4	104.4	104.4	104.4	104.4
Add Increase in year	21.7	21.4	21.8	25.8	-	-	-	-	-	-
Balance at end of year	35.4	56.8	78.6	104.4	104.4	104.4	104.4	104.4	104.4	104.4
Total Equity Equivalent	589.8	616.8	671.5	735.2	811.5	906.4	1,021.4	1,151.8	1,330.0	1,536.5

KOREA

SEVENTH RAILWAY PROJECT

KOREAN NATIONAL RAILROAD (KNR)

Calculation of Financial Ratios

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Working (%)	89	86	88	82	76	76	76	76	76	76
Operating (%)	102	98	98	90	83	83	83	83	83	83
Average net fixed assets in use (Won billion)	791.3	853.5	906.8	1,033.4	1,281.4	1,537.6	1,754.1	1,982.5	2,219.7	2,455.0
Rate of return on average net fixed assets in use (%)	N/A	0.3	0.3	3.2	5.5	5.5	6.0	6.0	6.0	6.0
Debt service coverage (times)	0.5	0.6	0.7	1.0	1.3	1.2	1.2	1.2	1.1	1.2
Interest charge coverage (times)	N/A	0.1	0.1	0.8	1.4	1.3	1.4	1.4	1.4	1.5
Current	0.9	1.1	1.0	0.9	1.1	1.3	1.4	1.5	1.5	1.7
Liquid	0.4	0.5	0.5	0.3	0.6	0.7	0.8	0.9	0.9	1.1
Debt to equity	33/67	37/63	39/61	41/59	46/54	48/52	48/52	49/51	47/53	45/55

KOREA

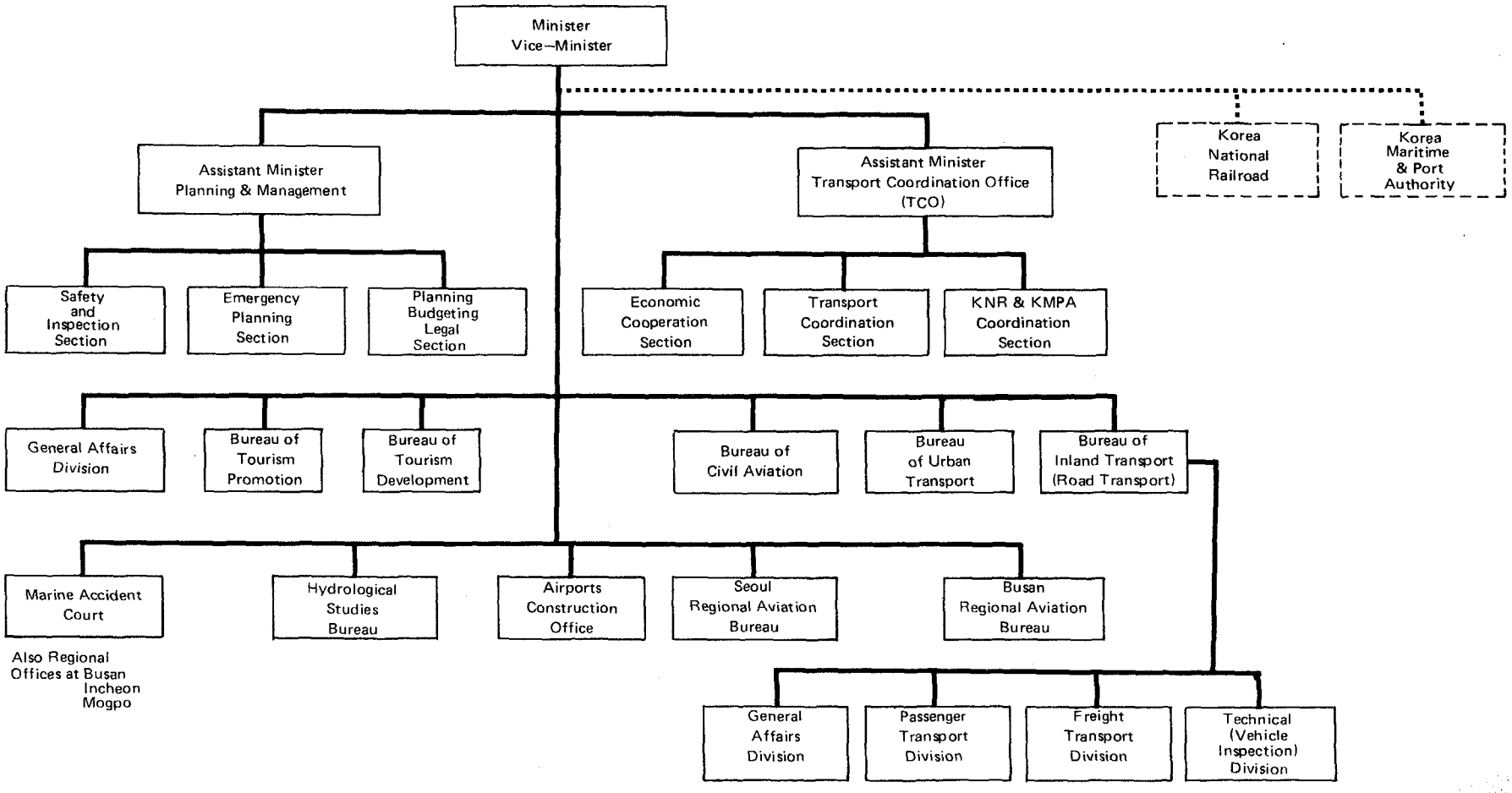
SEVENTH RAILWAY PROJECT

KOREAN NATIONAL RAILROAD

Sensitivity Analysis
Income Account - Cashflow - Balance Sheets

Sensitivity case	1980 1	1980 2	1980 3	1980 1	1980 2	1980 3	1980 1	1980 2	1980 3	1980 1	1980 2	1980 3
Income Account												
Net operating revenue (loss)	(40.5)	(3.7)	1.5	(80.2)	(4.8)	28.3	(140.2)	(27.8)	34.0	(214.1)	(54.4)	44.7
Net income (loss)	(57.7)	(20.9)	(15.7)	(134.0)	(58.6)	(25.5)	(207.2)	(94.8)	(33.0)	(292.4)	(132.7)	(33.6)
Cashflow												
Annual variation in working capital	(85.6)	(41.1)	(35.9)	(162.8)	(57.0	(42.2)	(247.3)	(97.5)	(50.6)	(342.8)	(144.0)	(60.5)
Balance Sheet												
Net working capital	(85.2)	(40.7)	(35.5)	(248.0)	(97.7	(59.4)	(495.3)	(195.2)	(95.1)	(838.1)	(339.2)	(140.0)
Net fixed assets	1,199.8	1,192.1	1,192.1	1,478.5	1,440.4	1,440.4	1,748.2	1,672.7	1,672.7	2,003.2	1,888.6	1,888.6
Other assets	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4
Total assets	1,170.0	1,206.8	1,212.0	1,285.9	1,398.1	1,436.4	1,308.3	1,532.9	1,663.0	1,220.5	1,604.8	1,804.0
Long-term debt	508.4	508.4	508.4	698.7	698.7	698.7	851.0	851.0	851.0	967.5	967.5	967.5
Equity equivalent	661.6	698.4	703.6	587.2	699.4	737.7	457.3	681.9	782.0	253.0	637.3	836.5
Total liabilities	1,170.0	1,206.8	1,212.0	1,285.9	1,398.1	1,436.4	1,308.3	1,532.9	1,633.0	1,220.5	1,604.8	1,804.0
Ratios												
Working (%)	106	93	104	116	93	85	129	98	85	141	103	85
Rate of return on net fixed assets in use (%)	NA	NA	0.01	NA	NA	2.2	NA	NA	2.2	NA	NA	2.5
Current	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Debt/equity	43/57	42/58	42/58	54/46	50/50	49/51	65/35	55/45	52/48	79/21	60/40	54/46

KOREA
SEVENTH RAILWAY PROJECT
MINISTRY OF TRANSPORTATION: ORGANIZATION

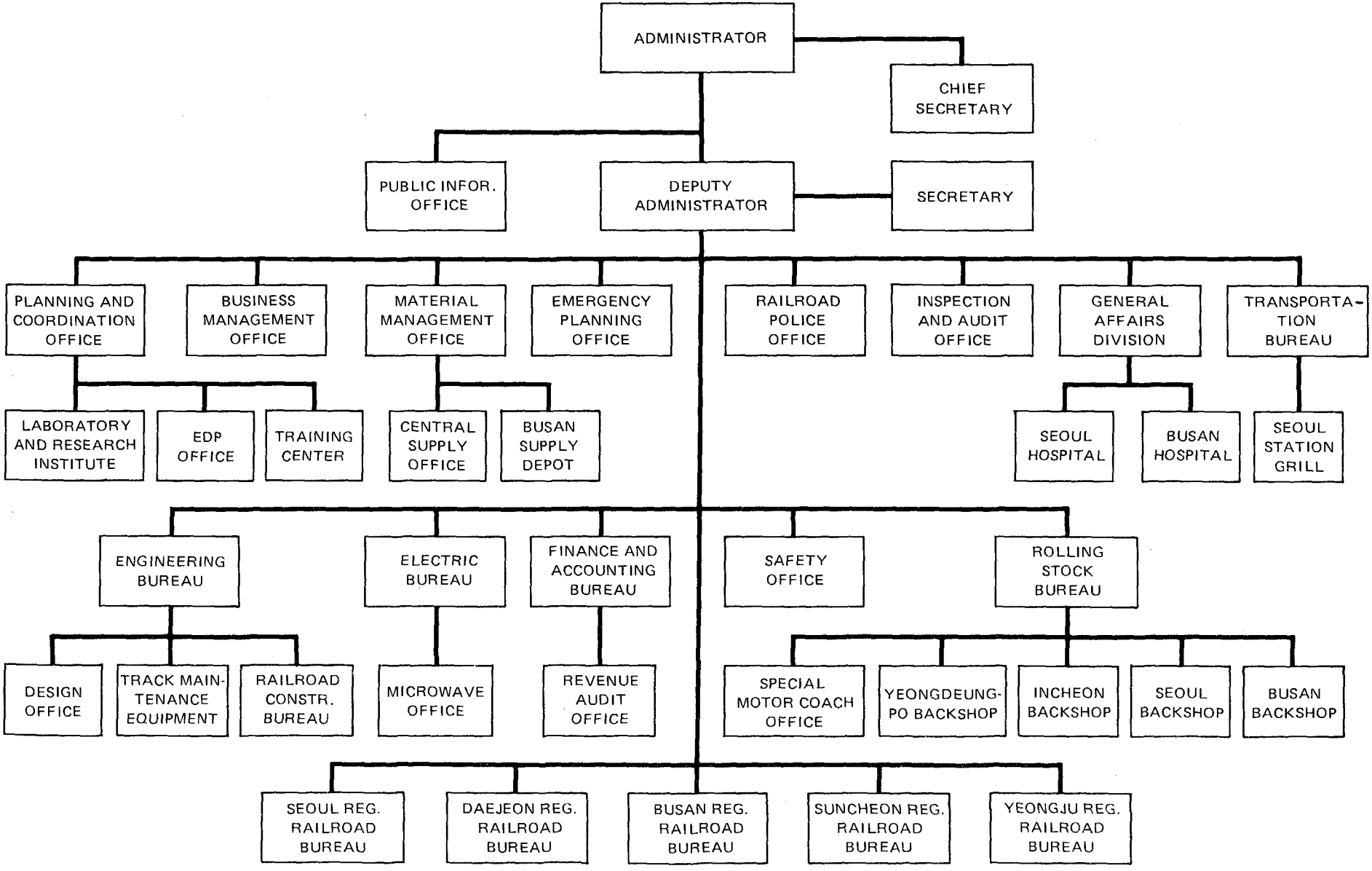


Note: Railways (KNR) and ports (KMPA) report directly through the Vice–Minister and Minister

Source: Ministry of Transportation

World Bank–19013

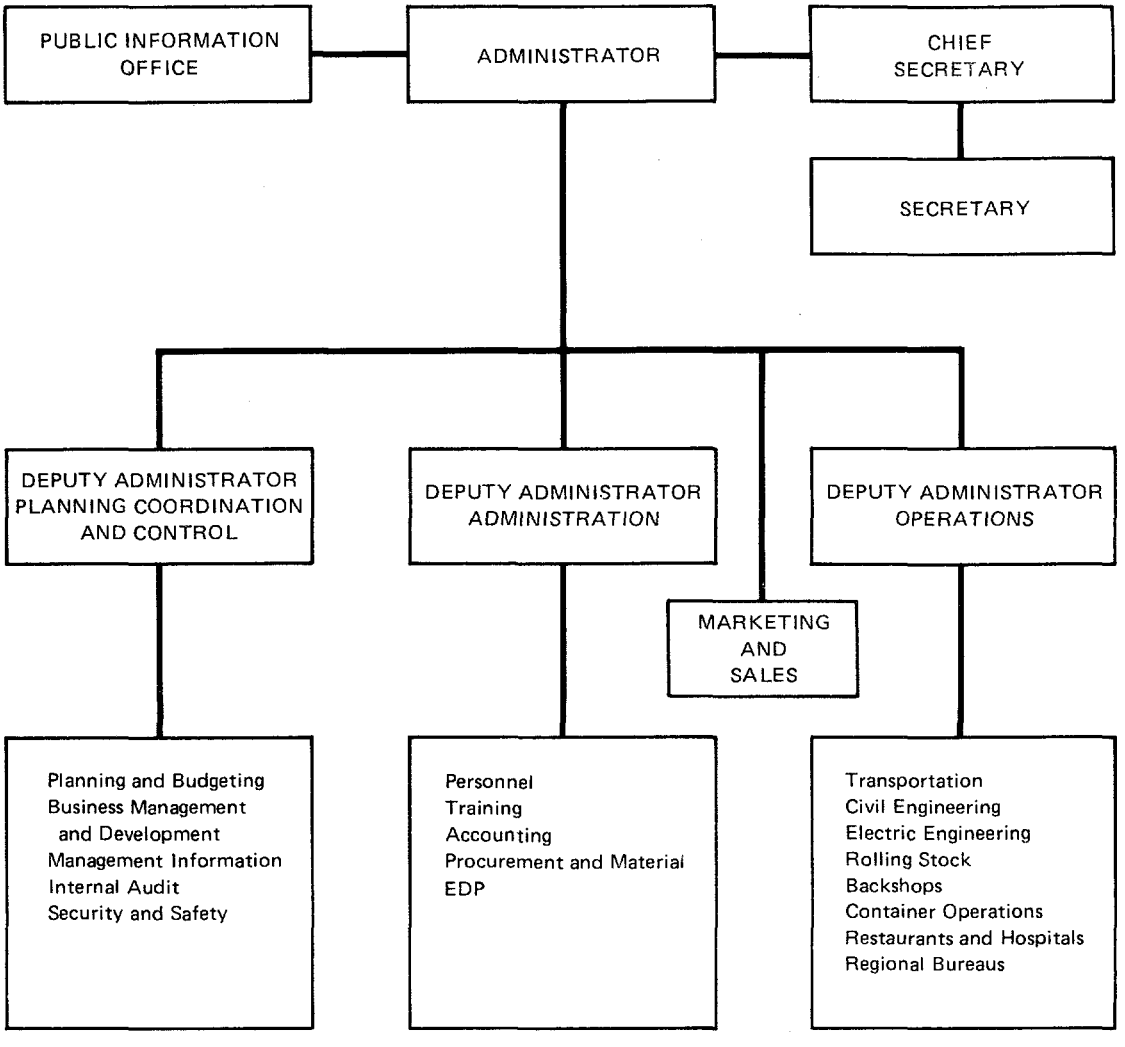
KOREA
SEVENTH RAILWAY PROJECT
ACTUAL KNR FUNCTIONAL ORGANIZATION



Source: KNR

World Bank – 20994

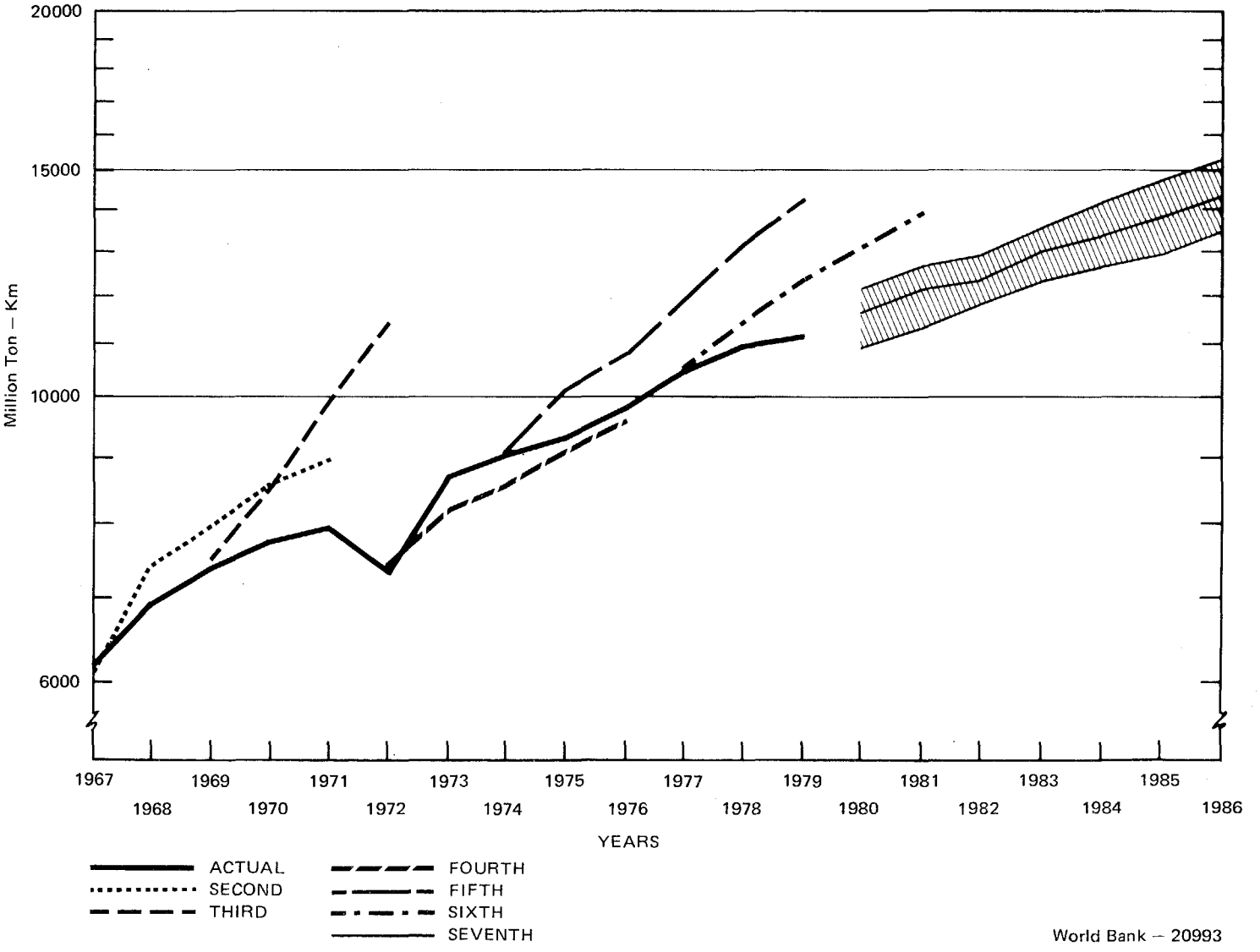
KOREA
SEVENTH RAILWAY PROJECT
RECOMMENDED KNR ORGANIZATION



Source: Consultants and Mission

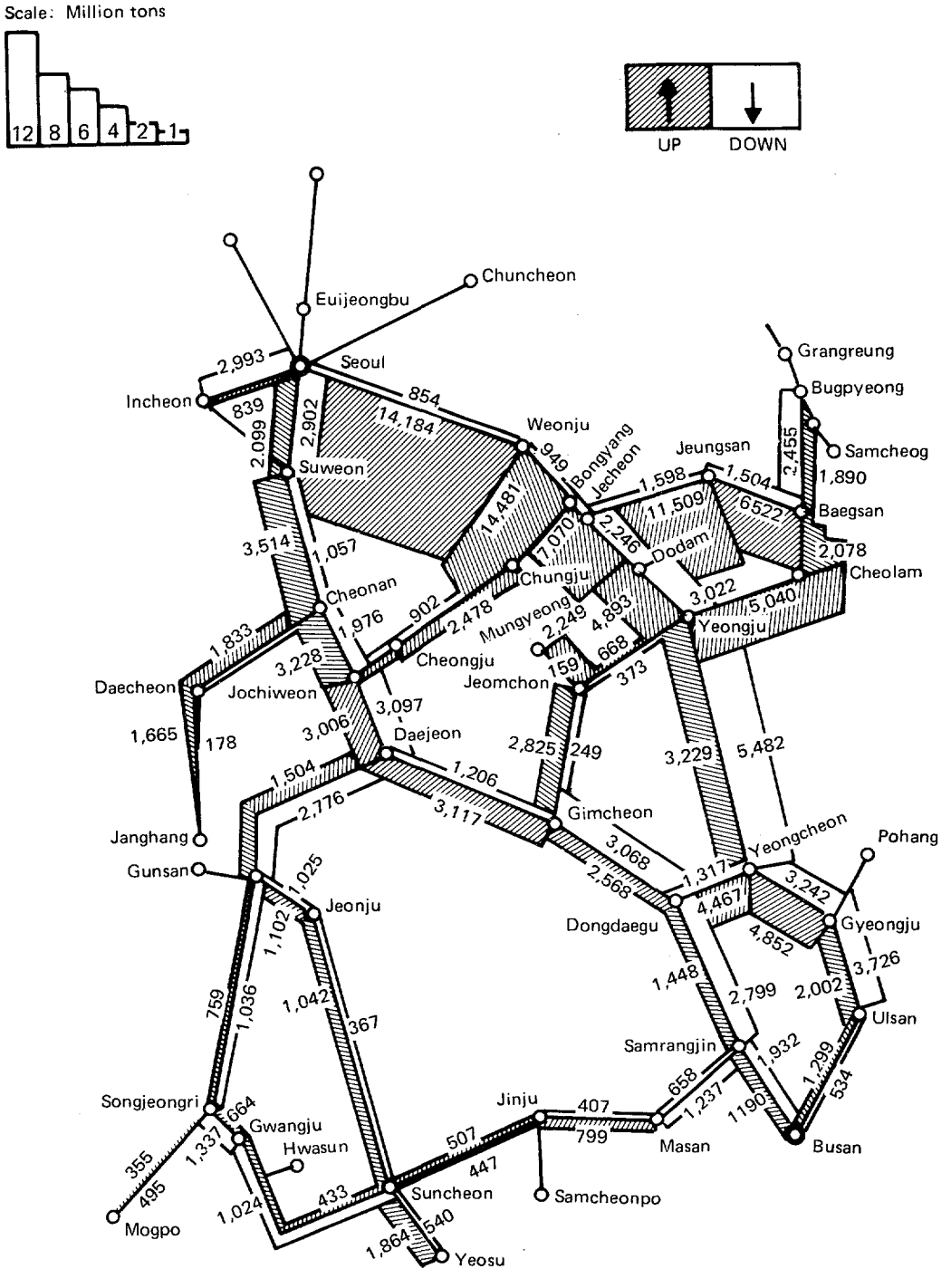
World Bank – 20995

KOREA
SEVENTH RAILWAY PROJECT
Freight Traffic Forecast and Actual
Second to Seventh Railway Projects, 1967–1986



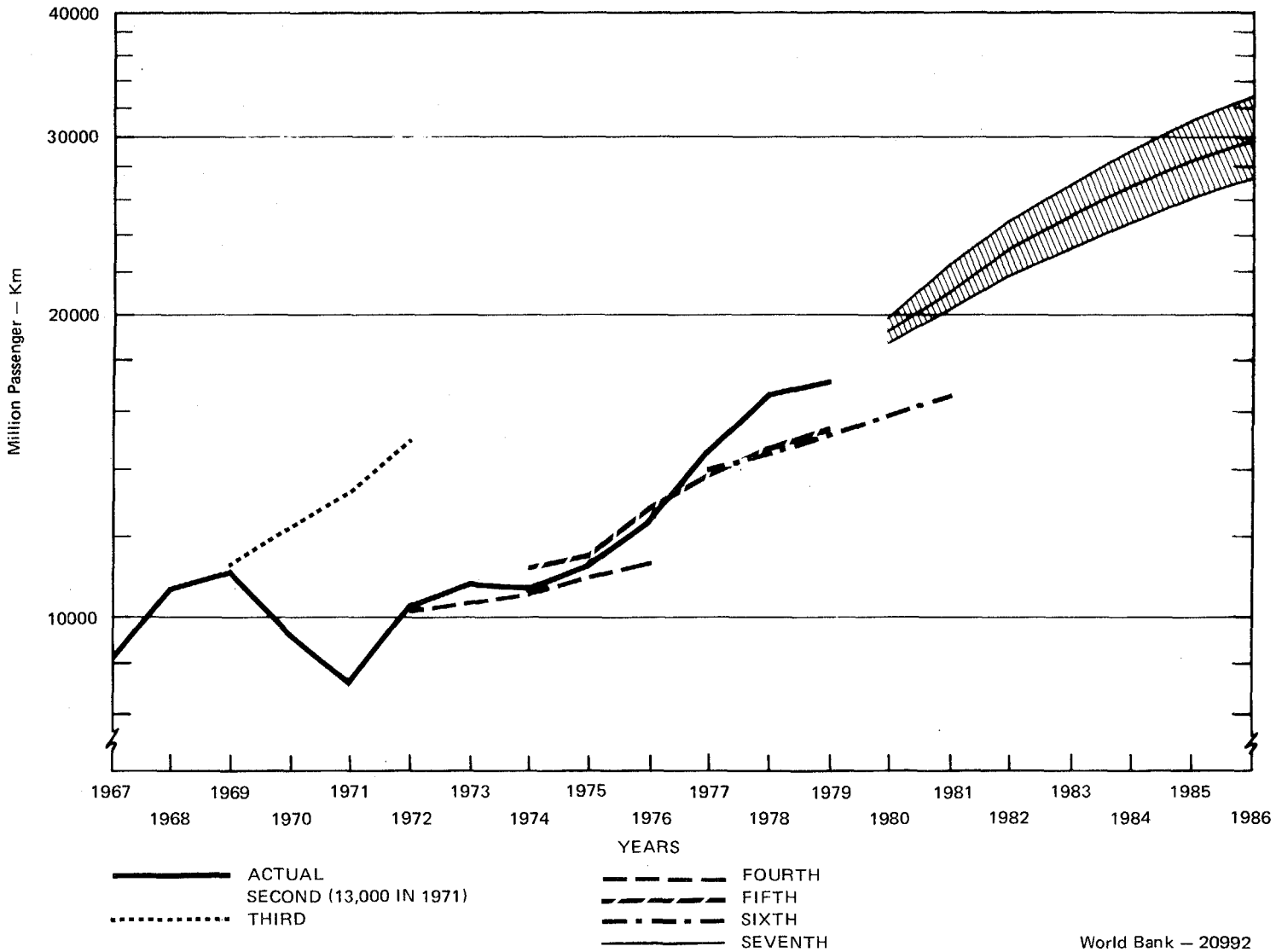
World Bank – 20993

KOREA
SEVENTH RAILWAY PROJECT
KNR FREIGHT TRAFFIC DENSITY
1978



World Bank – 21015

KOREA
SEVENTH RAILWAY PROJECT
Passenger Traffic Forecast and Actual
Second to Seventh Railway Projects, 1967–1986



KOREA

SEVENTH RAILWAY PROJECT

Selected Documents and Data Available in the Project File

A. General Reports and Studies on the Transport Sector

A-1 World Bank "Growth and Prospects of the Korean Economy," Annex F: Transport, Report No. 1489-KO, February 23, 1977.

A-2 Korea Institute of Science and Technology, "Coal/Cement Distribution and Optimum Transport Sector Investment Study," Interim Report, July 1979.

B. General Reports and Studies Relating to the Project

B-1 "Management Study" Report by consultants Overseas Bechtel, Inc. - SAMIL Accounting Corporation; September 1979 (financed under Fifth Railway Project, Loan 1101-KO).

B-2 "Technical and Economic Feasibility Studies of Major KNR Investments 1980-81" Report by Consultants Korean Development Association and Wilbur Smith and Associates; August 1979 (financed under Sixth Railway Project, Loan 1542-KO).

C. Working Papers

C-1 Central Government Transport Sector Investment Budgets, Fourth Plan 1977-81

C-2 Notes on the Forecast of Freight Traffic by Commodity

C-3 Investment Plan and Project

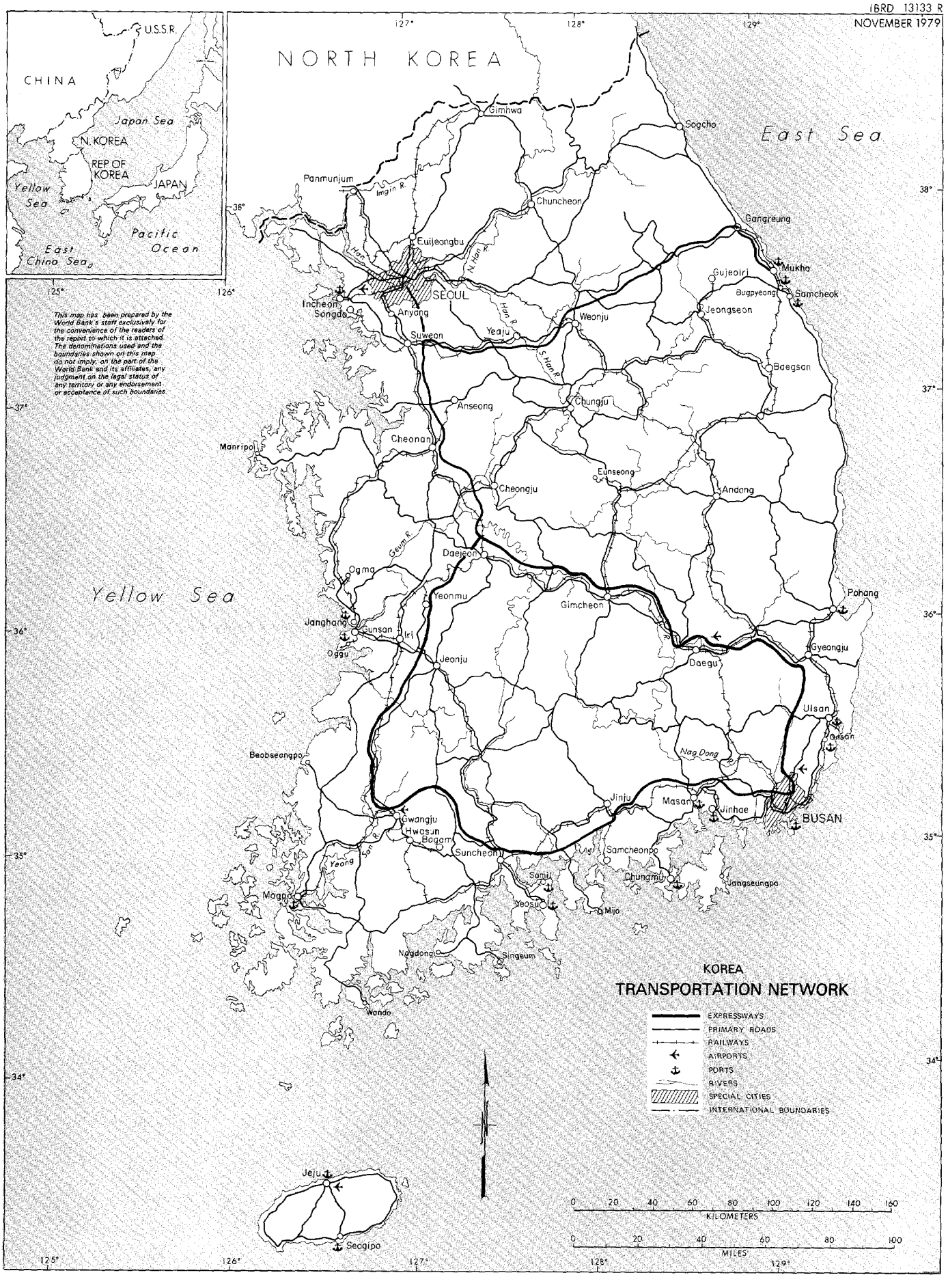
Table 1 KNR Locomotive Requirements, 1979-82
Table 2 KNR Railcar Requirements, 1979-82
Table 3 KNR Passenger Car Requirements, 1979-82
Table 4 KNR Freight Car Requirements, 1979-82
Table 5 Unit Prices for Project Items

C-4 Economic Evaluation of the Rail Renewal Program

C-5 Detailed Calculations for Financial Projections

Table 1 Traffic Costing, 1977-78
" 2 Planned Tariff Increases, 1980-1986
" 3 Operating Revenues: Passengers 1977-1981
" 4 Operating Revenues: Passengers 1982-1986

IBRD 13133 R
NOVEMBER 1979



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KOREA

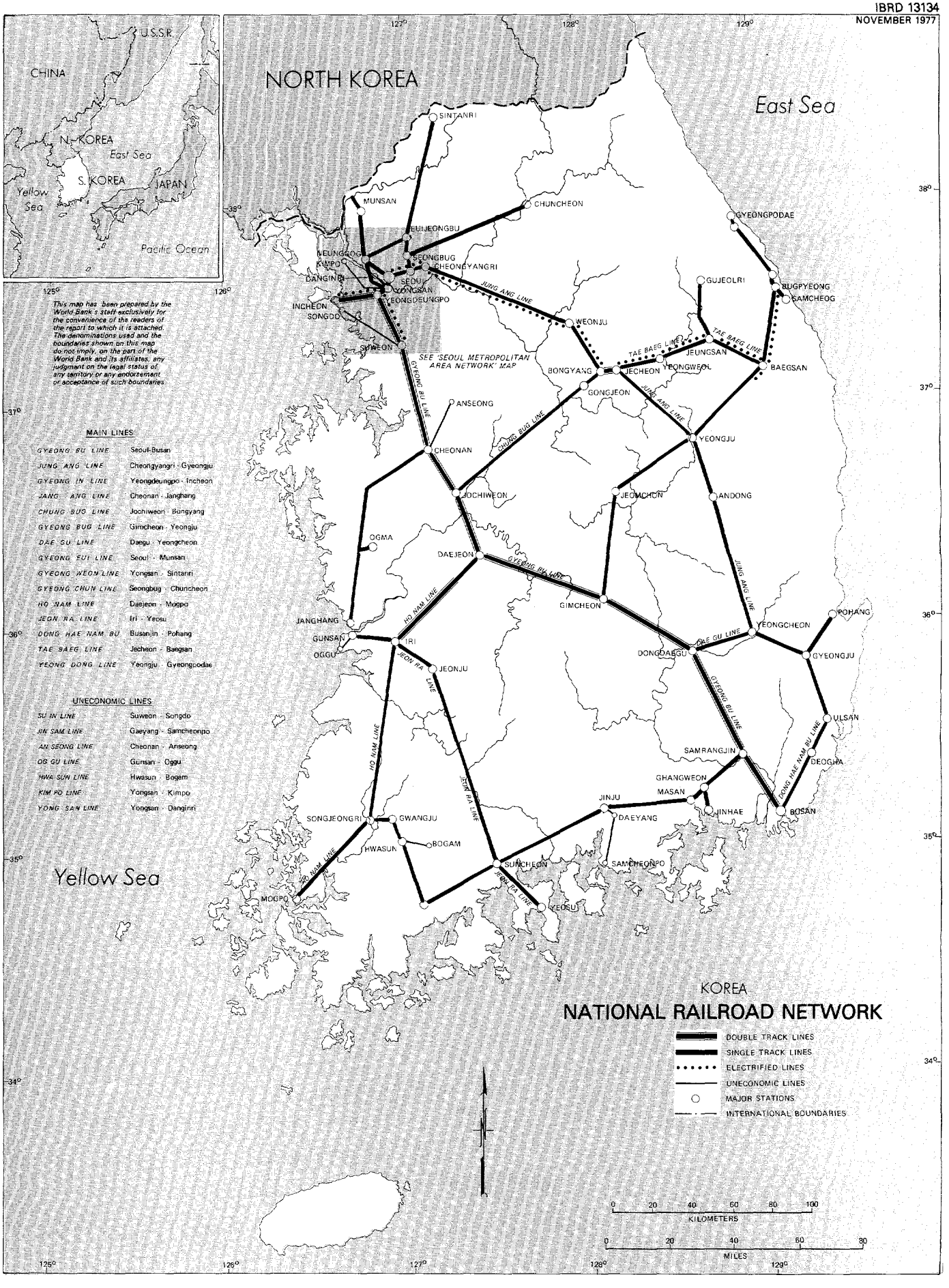
TRANSPORTATION NETWORK

- EXPRESSWAYS
- PRIMARY ROADS
- RAILWAYS
- AIRPORTS
- PORTS
- RIVERS
- SPECIAL CITIES
- INTERNATIONAL BOUNDARIES

0 20 40 60 80 100 120 140 160 KILOMETERS

0 20 40 60 80 100 MILES

IBRD 13134
NOVEMBER 1977



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MAIN LINES

GYEONG BU LINE	Seoul-Busan
JUNG ANG LINE	Cheongyangri - Gyeongju
GYEONG IN LINE	Yeongdeungpo - Incheon
JANG ANG LINE	Cheonan - Janghang
CHUNG BUG LINE	Jochiweon - Bungyang
GYEONG BUG LINE	Gimcheon - Yeongju
DAE GU LINE	Daegu - Yeongcheon
GYEONG SUI LINE	Seoul - Munsan
GYEONG WEON LINE	Yongsan - Sintanri
GYEONG CHUN LINE	Seongbug - Chuncheon
HO NAM LINE	Daejeon - Mogpo
JEON HA LINE	Iri - Yeosu
DONG HAE NAM BU	Busanjin - Pohang
TAE BAEG LINE	Jecheon - Baegsan
YEONG DONG LINE	Yeongju - Gyeongpodae

UNECONOMIC LINES

SU IN LINE	Suweon - Songdo
JIN SAM LINE	Gaeyang - Samcheonpo
AN SEONG LINE	Cheonan - Anseong
OG GU LINE	Gunsan - Oggu
HWA SUN LINE	Hwasun - Bogam
KIM PO LINE	Yongsan - Kimpo
YONG SAN LINE	Yongsan - Danginri

IBRD 13135R
NOVEMBER 1979

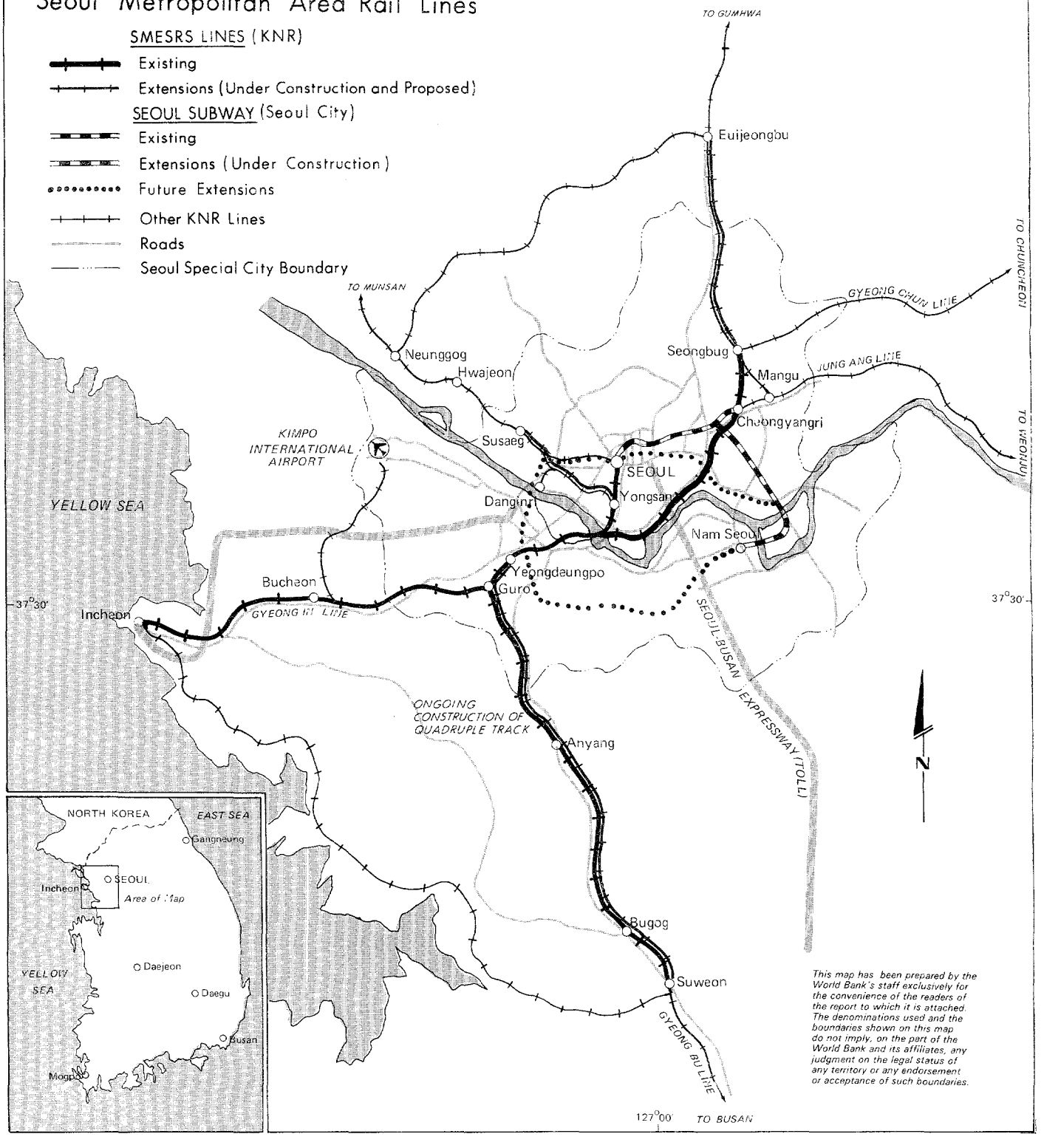
KOREA

Seoul Metropolitan Area Rail Lines

SMESRS LINES (KNR)
- Existing
- Extensions (Under Construction and Proposed)

SEOUL SUBWAY (Seoul City)
- Existing
- Extensions (Under Construction)
- Future Extensions

- Other KNR Lines
- Roads
- Seoul Special City Boundary



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